Chapter 3 Obligations of Vietnam Government

For the project implementation, the following have to be undertaken by the Government of Vietnam.

(1) Items to be Managed by the Government of Vietnam

1) Managing and undertaking items and matters which will not be covered by the Japanese Grant Aid Scheme
2) Appropriate use and maintenance of the facilities to be constructed based on the E/N for the project
3) Investigation of unexploded bombs and their disposal, when found on/around facilities to be constructed and pipelines' routes

(2) Items to be Constructed and Financed by the Government of Vietnam

1) Land acquisition for the construction sites
2) Land development work for the construction sites
3) Construction of access roads to construction sites
4) Preparation/arrangement of temporary-use lands for temporary storage yards and construction works, during the construction period
5) Supply of public electricity to treatment facilities and wells
6) Drainage works from the treatment facilities
7) Construction of gates and fences in facilities.
8) Installation work of 'block service pipes"
9) Installation work of "house connection service pipes" (including procurement of a part of service pipes' materials and house-connections' materials)

(3) Procedures for the Project Implementation

1) The payment for the commission to be decided based on the treaty between banks to a Japanese bank
   - Commission for the Agreement of Payment (A/P)
   - Commission for the Payment
2) Taking necessary measures of tax exemption for the equipment transported for the project at the port for unloading
3) Issuing permission to enter and leave to/from the Socialist Republic of Vietnam, and approval to work for the period between entering and leaving for Japanese(s) or Japanese firm(s) to deal with the procurement of the equipment and its service on the basis of the contract verified by the Government of Japan
4) Taking necessary measures to exempt the domestic tax in Vietnam and other levies for Japanese(s) or

Japanese firm(s) to deal with the procurement of the equipment and its service on the basis of the contract verified by the Government of Japan

5) The payment for the expense of the construction, installation, equipment transportation and others which are not to be taken in Japanese Grant Aid Scheme

(4) Estimated Costs to be Financed by the Vietnam Side

Work items and the estimated costs to be borne by the Vietnamese side is listed below:

Work items and the their costs tentatively estimated (Total: US$ 1,393,864) to be borne and financed by the Vietnamese side is listed below:

Table 3.1 Estimated Costs to be Financed by Vietnamese Side

No.	Work Item	Amount (US$)
1)	Land acquisition (For wells, treatment facilities and reservoirs)	$ 183,862
2)	Land development work (For the above)	$ 78,966
3)	Access roads construction (To the above construction sites)	$ 16,437
4)	Temporary land use cost (To use as temporary storage yards during construction period)	$ 67,261
5)	Public electricity supply works (To wells and treatment facilities)	$ 156,143
6)	Drainage works (Drainage from treatment facilities to outsides)	$ 39,517
7)	Construction of gates and fences (In sites of wells, treatment facilities and reservoirs)	$ 46,552
8)	Installation work of “Block Service Pipes” (Pipes: OD 40mm of PE and Branch-Tee to be supplied by the Grant Aid)	$ 493,647
9)	Installation work of “House Connection Service Pipes” (Water meters and 20 mm PE pipes (20 m long each house) to be supplied by the Grant Aid)	$ 366,480
Total		US$ 1,448,865

Exchange rate: US$ 1.00 = Japanese Yen 123.46 = VND 14,732
VND 1.00 = Japanese Yen 0.0084

Aforementioned Vietnamese portion cost is divided by each commune as follows:

Table 3.2 Cost by Commune to be Borne by Vietnamese Side

Province	Commune	Amount (US$)
Thai Nguyen	No.1: Hoa Thuong	160,870
	No.2: Dong Bam	138,734
	No.3: Thinh Duc	120,215
	No.4: Nam Tien	142,895
	Sub Total	562,713
Ninh Binh	No.5: Dong Phong	139,413
	No.6: Quang Son	112,463
	No.7: Yen Thang	141,915
	Sub Total	393,792
Thanh Hoa	Nos.8&9: Vinh Thanh and Vinh Loc	164,182
	No.10: Dinh Tuong	117,662
	No.11: Van Ha (Thieu Hung)	130,925
	No.13: Van Thang	79,591
	Sub Total	492,360
Total	12 communes in 3 Provinces (11 systems)	US$ 1,448,865

Chapter 4 Project Operation Plan

4-1 Managemant Organization on Construction Stage

Management organizations shall be established to implement the project. The organizations shall be separately established for construction stage and operation and maintenance (O/M) stage.

At present, on going projects aided by UNICEF and DANIDA (Danish International Development Assistance) have established Project Management Unit (PMU) in CERWASS. This project will also establish similar PMU and the organization is shown below:

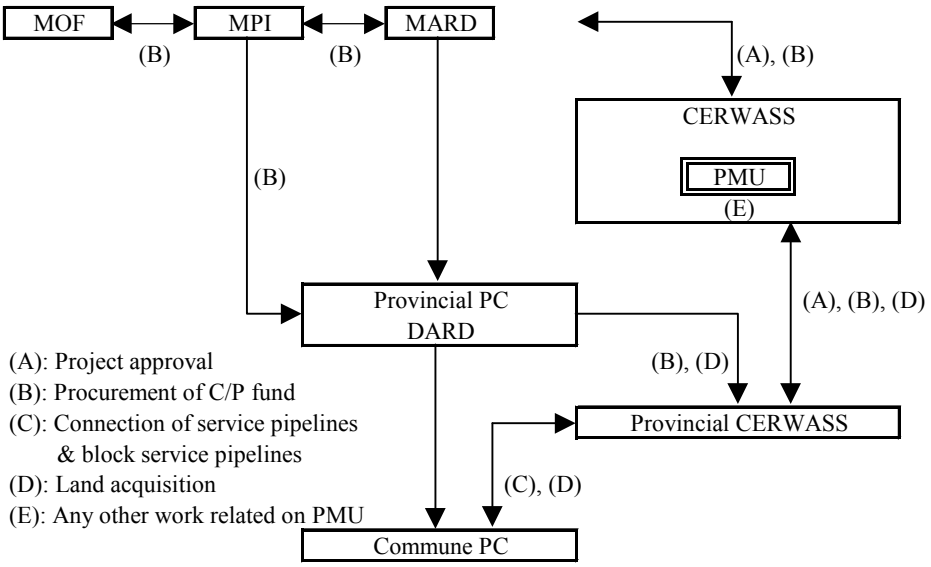


Fig.4.1 Related Organization of the Project Implementation

Referring the above figure, (A): CERWASS applies project application, that is applied by P-CERWASS to MARD and MPI, and it is approved. (B): A part of counterpart (C/P) fund remitted to the Provincial Peoples' Committee is mainly for land acquisition and the other fund is remitted to PMU for construction cost on the Vietnamese responsibility. (C): P-CERWASS handles all required process for connecting service pipelines, the required process is such as the contracting with residents, receiving the construction fee, and designing and constructing pipelines. All the properties are transferred to O/M organizations after the construction is completed. Block service pipelines are constructed with C/P fund by P-CERWASS so as to be impartial among the residents on the construction cost of the service pipelines. All the properties are transferred to the O/M organizations after the construction completion. (D): Land acquisition is secured by P-CERWASS with cooperation of Commune People's Committee. (E): As any other work related on PMU, it coordinates construction work of Vietnam side and Japanese side. Organization chart of PMU is shown below.

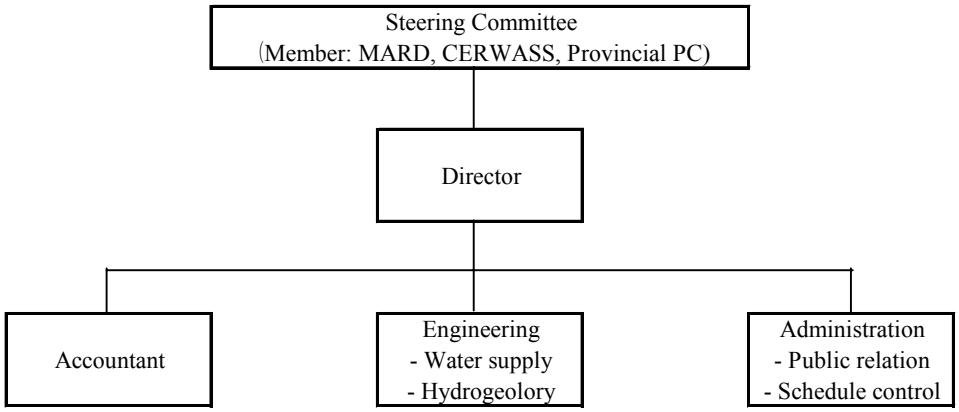


Fig 4.2 Organization Chart of PMU

Steering Committee is established in the upper organization of the PMU. It coordinates with related governmental institutes and deals administratively permission and approval of the project implementation.

4-2 Operation and Maintenance

(1) Management Organization on Operation and Maintenance Stage

Management organization of operation and maintenance stage is established in the P-CERWASS as Vietnam side proposed. P-CERWASS of Thai Nguyen Province manages the operation and maintenance of the water supply facilities in the communes of No.1 to No.4 (Hoa Thuong, Dong Bam, Thinh Duc and Nam Tien). In the same way, P-CERWASS of Ninh Binh works for communes of Nos.5, 6 and 7 (Dong Phong, Quang Son and Yen Thang,) and P-CERWASS of Thanh Hoa for communes of Nos.8 & 9, 10, 11, 13 (Vinh Thanh & Vinh Loc, Dinh Tuong, Van Ha (Thieu Hung) and Van Thang).

It is designed that submersible pumps are installed in deep wells to pump up water for water supply. Water treatment plants to remove iron and manganese are constructed in six sites. Hence at least, water supply engineers, mechanical engineers and electrical engineers are required to operate and maintain the facilities. It might be difficult to secure the engineers by commune unit. Accordingly it is recommended that the required engineers are secured in P-CERWASS and the engineers are to check the water supply facilities, and train the operators to handle the minimum requirements in communes.

Regarding magnitude of management scale, average budget of communes is about 600 million VND/year/commune and required operation and maintenance cost is about 150 - 380 million VND/year/commune. It is very risky if a commune manages the water supply system that occupies almost one half of the commune budget.

It is appropriate if there is not much different in water charge based on a water tariff system, as public charge, in a same territory such as a province. If P-CERWASS manages the water supply system, the water charge can be flat in the province. And more

scale-merit is expected if P-CERWASS manages the system than commune manages it, as plural communes' water supply systems with a lot of served population are managed in a lump.

As a conclusion, it is appropriate that P-CERWASS manages the water supply systems.

Water supply management shall be on a self-supporting accounting system, all O/M cost is covered by income of water charge, as management policy. Based on the socio-economic survey, it is observed that effective water rate could be high as residents have high willingness to pay and the affordability. Water supply facilities are designed in accordance of saving energy on electricity, chemical and others. Hence, applying the self-supporting accounting system is possible.

Organization chart of the operation and maintenance is shown below, and the organization, Water Management Unit (WMU) as tentative name, is established in P-CERWASS. Decision and approval of the management policy is in charge of the upper organization of the WMU, that is Water Management Board Meeting. Water tariff system is decided in a level of Provincial People's Committee in the three provinces.

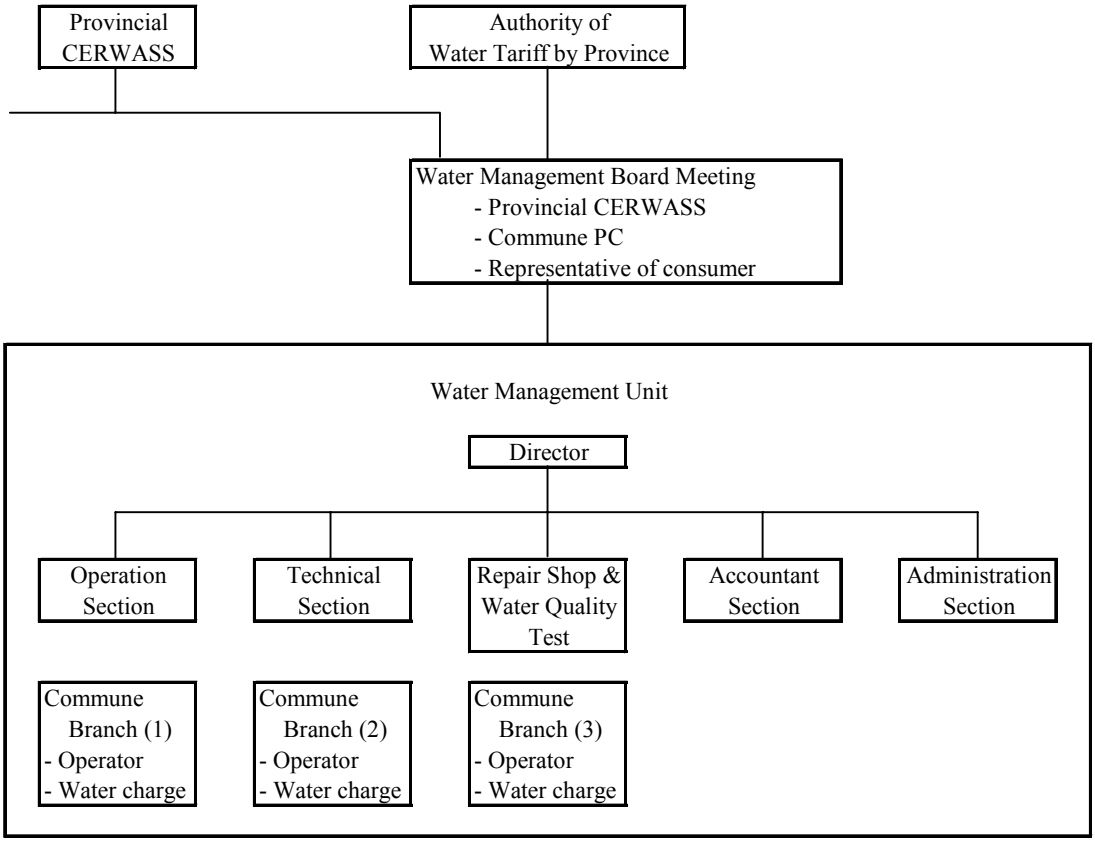


Fig. 4.3 Organization Chart of WMU

Present P-CERWASS has water supply engineers in the organization and it has wholly supported existing small scale water supply systems managed in other communes. P-CERWASS has a program to shift the engineers to WMU timely. And it is possible that training course organized by CERWASS can train water supply engineers.

WMU sets up branch offices in each commune having the water supply system. The branch offices carry out O/M of the water supply facilities and collect water charge. The staff shall be secured in each commune and the staffs can be available based on the socio-economic survey. Staffs of the main WMU office train the staffs of the branch office.

Required number of the staffs is shown below. There is one (1) Director in each WMU in P-CERWASS and there are 1 to 3 staffs in each section in the WMU in the P-CERWASS. Work contents of the sections are shown below. In the branch office of the WMU, number of operators is 6 when water treatment plant is constructed in the commune, and 4 for communes without the plant. Number of water charge collectors is estimated based on the number of the households in the commune.

Table 4.1 Number of Required Staff

Province/commune		Treatment plant	No. of household in 2005 (household)	Main Office	Branch Office		Total
				Director and Staff (person)	Operators (person)	Water charge collectors (person)	(person)
Thai Nguyen				10			10
No.1	Hoa Thuong	Yes	1,850		6	4	10
No.2	Dong Bam	Yes	1,440		6	3	9
No.3	Thinh Duc	No	830		4	2	6
No.4	Nam Tien	Yes	1,080		6	3	9
Total			5,200	10	22	12	44
Ninh Binh				8			8
No.5	Dong Phong	No	2,360		4	5	9
No.6	Quang Son	No	1,220		4	3	7
No.7	Yen Thang	No	2,100		4	5	9
Total			5,680	8	12	13	33
Thanh Hoa				10			10
Nos. 8&9	Vinh Thanh & Vinh Loc	Yes	3,100		6	7	13
No.10	Dinh Tuong	Yes	1,520		6	4	10
No.11	Van Ha (Thieu Hung)	Yes	1,730		6	4	10
No.13	Van Thang	No	770		4	2	6
Total			7,120	10	22	17	49

(2) Operation and Maintenance Cost

Operation and maintenance (O/M) cost is consisted of cost for personnel, electricity, chemicals, repairs of facilities, and others. Annual O/M cost will be 906 milllion VND/year in Thai Nguyen, 616 million VND/year in Ninh Binh and 1,144 million VND/year in Thanh Hoa; totaling 2,667 million VND/year in 3 Provinces.

Table 4.2 Annual O/M Cost by Province (At the Year 2001 Price Level)

Province	O/M Cost (Unit: 1,000 VND)					
	(A) Personnel	(B) Chemicals	(C) Electricity	(D) Repairs	(E) Others	Total
Thai Nguyen	340,800	51,521	201,927	280,154	43,720	918,123
Ninh Binh	242,400	26,371	169,819	150,962	29,478	619,030
Thanh Hoa	364,800	211,518	264,969	271,493	55,639	1,168,419
Total	948,000	289,410	636,715	702,609	128,837	2,705,572

(3) Water Tariff Proposed

Based on the above O/M costs, water tariff per one cubic meter is calculated and proposed by each province.

Table 4.3 Water Tariff Calculation (At the Year 2001 Price Level)

Province	A	B	C = A/B	D (Rounded)
	Annual O/M Cost	Annual Water Volume to be Sold	Unit Water Cost	Water Tariff Proposed
	1,000 VND/Year	m3/year	VND/m3	VND/m3
Thai Nguyen	1,079,465	525,600	2,054	2,100
Ninh Binh	627,305	573,050	1,095	1,100
Thanh Hoa	1,361,656	719,050	1,894	1,900
Total	3,068,426	1,817,700	1,688	1,700

The tariff will be 2,100 VND/m3 in Thai Nguyen, 1,100 VND/m3 in Ninh Binh and 1,900 VND/m3 in Thanh Hoa; averaging 1,700 VND/m3 in 3 Provinces.

Among three Provinces, water tariff in Ninh Binh (1,100 VND/m3) is estimated cheaper than other provinces (2,100 or 1,900 VND/m3). This is because of that groundwater quality in 3 communes in Ninh Binh Province is good and no treatment facilities are required.

(4) Affordability to Pay

Table 4.4 Affordability to Pay

Province	Unit Price of Water	Water Use (m3/house/month)	Water Tariff (per Household)
Thai Nguyen	2,100 VND/m3	8 m3/house	16,800 VND/month
Ninh Binh	1,100 VND/m3	8 m3/house	8,800 VND/month
Thanh Hoa	1,900 VND/m3	8 m3/house	15,200 VND/month

Note: Water use for one household per month
= 0.06 m3/person x 4.2 persons/household x 30 days = 7.56 m3 → 8.0 m3/month/household

The water tariff to be paid by each household will be:

- 16,800 VND/month/household in Thai Nguyen,
- 8,800 VND/month/household in Ninh Binh, and
- 15,200 VND/month/household in Thanh Hoa.

In the households survey conducted in all communes during the Basic Design Study period, people expressed the willingness to pay for water at the amount of about 15,000 VND/month/household. Therefore, the above water charge is considered to be within affordability to pay of peoples in the commune.

Chapter 5 Project Evaluation and Recommendations

5.1 Project Effect

(1) Improvement of Living Standard

In the project sites, most people presently use shallow well water. The shallow well is not always satisfactory in water quality and often dried up in dry seasons; it forces people go to remote wells or streams/rivers to take water for their daily use. With the completion of water supply facilities by the project, households will be able to receive safe water stably in 24 hours. Accordingly people's living standard will be greatly improved.

(2) Improvement of Sanitary Conditions

In the project sites, waterborne diseases such as troubles of skin or eyes, and diarrhea have frequently occurred. The project aims to supply safe water through pressured pipelines; excessive iron/manganese contained in the groundwater is to be removed and bacteria including coli-forms are to be disinfected by chlorination. Thus, such diseases will be certainly decreased, with the completion of the project,

(3) Promotion of Deep Well Construction Work

CERWASS, implementing agency of the project, can construct deep wells by its own effort, using well drilling machinery supplied by the project.

The above is summarized in the following table.

Table 5.1 Promotion of Deep Well Construction Work

Present Status	Input of the Project	Effect and Improvement
Most people use shallow well water which is not always safe in water quality and often dried up in dry seasons; it forces people go to remote wells or streams/rivers to take water for their daily use.	Public water supply systems are to be constructed. The system composes of deep groundwater source, treatment facilities, distribution facilities and service pipes. The service level is house connection system and in 24 hours supply.	With completion of the project, households can obtain safe water in 24 hours, and daily living condition of people can be improved in water use. Service population : 75,400 Service coverage : 82%
Due to shortage of safe water, water borne diseases are frequently occurs.	Same as the above	With the project, the diseases will certainly decrease.
Deep well construction work meets difficulty, because the existing drilling machine is old and not functioning well.	Supply of functional well drilling machinery.	Construction of deep wells can be progressed, contributing to the national policy of rural water supply program.

5.2 Justification of the Project

This project is considered to be reasonable for the implementation of the Japan's Grant Aid scheme according to the following:

1) The beneficiaries of the project, people receiving water produced by the project are rural inhabitants in the northern provinces of the country; income level of the provinces, GDP is only 1/2 of the whole country's GDP.

2) The purpose of the project is domestic water supply and meet one of Basic Human Needs (BHN) urgently required for improvement of living conditions.

3) The water supply facilities constructed by the project can be technically operated and financially maintained. The O/M budget can be produced by the monthly water charge to be paid by the users, commune people. The water charge has been confirmed within their affordability. Operational technology for the facilities has no difficulties since the facilities consist of conventional and normal ones in Vietnam. As for personnel, technicians are to be transferred from the existing P-CERWASS organization and simple workers such as water-meter readers and money collectors are to be employed among commune people.

4) Well drilling machinery supplied by the project is to be utilized by CERWASS for construction of new deep wells according to the national program of rural water supply sector, after completion of the project.

5) The purpose of the project thoroughly meets the basic policy of the "National Rural Clean Water Supply and Sanitation up to Year 2020"

6) The project is not profitable. Monthly water charge paid by commune people is to be expended for actual costs of O/M.

7) The project aims to improve living conditions in rural areas, and there is no other factors to make environment worse.

8) The project can be implemented under the Japan's Grant Aid Scheme without particular difficulties.

5.3 Conclusion

The project, as mentioned above, can expect the remarkable effect, improvement of rural people's living conditions; greatly contributes to advance BHN. Hence, it is concluded with recommendation that the project be implemented by the scheme of Japan's Grant Aid. As for O/M of facilities constructed by the project, it has been confirmed that personnel and costs for O/M can be prepared by the Vietnamese side, without much difficulties.

5.4 Recommendations

In order to implement the project smoothly and to keep sustainable O/M of the water supply facilities constructed by the project, the following recommendations or issues are presented.

(1) Smooth Implementation and Securing Budget for Vietnamese Side's Scope of Work

In order to make implementation of the Vietnamese side's scope of work secure, preparation of the budget in appropriate time according to the Vietnamese fiscal year period is necessary. The scope of work by the Vietnamese side includes land acquisition, land development work, electricity supply work and so on which are to be executed prior to the actual construction work of the project. Installation of block service pipes, the Vietnamese side's scope of work is to be executed in cooperation with progress of installation work of distribution pipelines. House connection work is also the Vietnamese side's responsibility. It shall be implemented through the procedure of receipt of applications of households and connection fees to be borne by the households. To implement the above smoothly without delay, an organization of Project Management Unit (PMU) shall be established in the Central CERWASS, and it shall supervise the progress of the project implementation in cooperation with other organizations concerned. At the same time, Water Management Unit (WMU) shall be established in each province for O/M of the water supply facilities.

(2) Sound Business of the Waterworks

As a result of the financial study for the project, water tariff or monthly water charge covering O/M costs is found affordable for the people, and the Provincial PC shall establish appropriate water tariff structure to keep the water supply business sound. To this purpose, the P-CERWASS shall be strengthened with establishment of new WMU roles of which includes Information, Education and Communication (IEC) activities to people. The P-CERWASS is required to increase water supply technology and aim effective management. The WMU is required to stand on sound business with financial self-support by way of stable income of water charge.

(3) Appropriate O/M for Facilities

As pipelines, one of important elements of water supply facilities, will tend to increase water leakage volume according to the working age, leakage prevention works on pipelines shall be continuously carried out in order to keep the proposed leakage loss of 10% even in the future. The leakage prevention work will contribute to sound water supply business by increasing the amount of paid water. On the other hand, supply of safe water with good quality is the important role of water supply business; to this end, strict water quality control shall be performed, from water intake to house connections. From a viewpoint of water source protection, IEC activity to people is important as well as water source patrol. Further, appropriate O/M for both cases of routine and emergency is required, through understanding and management of design drawings and operation manuals and so on.

(4) Future Extension Program of Water Supply Facilities

For the increase of water supply capacity in the future according to expansion of service area and increase of per capita consumption, extension work is able to be executed with additional construction work of wells and pipelines in the future by the Vietnamese effort. For that purpose, periodical review of the water supply plan for the communes is required.

(5) Strengthening of Central CERWASS

Rural water supply project is placed on high priority in Vietnam, and a basic national program towards the year 2020 has been established. Based on the program, the Government of Vietnam makes efforts to promote construction of water supply facilities, taking the national budget and international aids. However, in the framework of the present regulation for approval and implementation of new water supply projects, people's benefits/costs in rural areas and subsidies from the Government are not always fair. Public rural water supply system is to be based on the clear standards on technical and financial aspects at the stage of the Government approval. Although the evaluation and approval of new projects are considered to be managed by the Central CERWASS, presently the CERWASS is not necessarily entitled to do so. Hence, it is recommended that the CERWASS be strengthened in organization and its roles, and carry out approval of new water supply projects promptly. In the course of the progress of new water supply projects, all information of the systems shall be collected and controlled by one organization. These information are at least necessary for the systems' extension and improvement in the future, and these shall be handled by the Central CERWASS.

Content of Appendices

[Appendix-1] Member List of the Study Team

1. Basic Design Study (June - July 2001)

Members of the Mission

No.	Name	Assignment	Position
1	Mr. Yoshiki OMURA	Leader	Senior Advisor, Institute for International Cooperation, JICA
2	Mr. Hidetake AOKI	Coordinator	First Project Management Div., Grant Aid Management Dept., JICA
3	Mr. Hideki YAMAZAKI	Chief Consultant/ Water Supply Planner	Docon Co., Ltd.
4	Mr. Kazuo HIRAYAMA	Hydrogeologist	Pacific Consultants International
5	Mr. Toshifumi OKAGA	Groundwater Development Planner	Pacific Consultants International
6	Mr. Masami OGURA	Water Supply Facility Planner	Docon Co., Ltd.
7	Mr. Masaru FUJITA	Geophysicist	Docon Co., Ltd.
8	Mr. Yuichi HASHIMOTO	Socio-economy / Operation and Maintenance Planner	Pacific Consultants International
9	Mr. Keiji NAKAOKA	Procurement Planner / Cost Estimator	Docon Co., Ltd.
10	Mr. Kimio NISHIMURA	Coordinator	Docon Co., Ltd.

2. Explanation on Draft Report of Basic Design (December 2001)

Members of the Mission

No.	Name	Assignment	Position
1	Mr. Hisatoshi OKUBO	Leader	Deputy Director, First Project Management Div., Grant Aid Management Dept., JICA
2	Mr. Hisashi NOGUCHI	Grant Aid Cooperation	Grant Aid Div., Economic Cooperation Bureau, Ministry of Foreign Affairs
3	Ms. Nobuko NISHIMURA	Coordinator	Welfare and Labor Relations Div., Personnel Dept., JICA
4	Mr. Hideki YAMAZAKI	Chief Consultant/ Water Supply Planner	Docon Co., Ltd.
5	Mr. Masami OGURA	Water Supply Facility Planner	Docon Co., Ltd.
6	Mr. Yuichi HASHIMOTO	Socio-economy / Operation and Maintenance Planner	Pacific Consultants International
7	Mr. Keiji NAKAOKA	Procurement Planner / Cost Estimator	Docon Co., Ltd.
8	Mr. Shogo SHIBATA	Equipment Planner	Docon Co., Ltd.

[Appendix - 2] Study Schedule

1. Basic Design Study (June - July 2001)

	Date	Week	Survey Schedule										Hotel
			Government Member		Consultant Member								
			Omura Leader	Aoki Coordinator	Yamazaki Chief Consultant/ Water Supply Planner	Hirayama Hydrogeologist	Okaga Grandwater Development Planner	Ogura Water Supply Facility Planner	Fujita Geophysicist	Hashimoto Socio-economy/ Operation and Maintenance Planner	Nakaoka Procurement Planner/ Cost Estimator	Nishimura Coorr\dinator	
			G1	G2	C1	C2	C3	C4	C5	C6	C7	C8	
1	31 May	Thr.			Arriva in Hanoi／Internal meeting							←The Same left	Hanoi
2	1 June	Fri.		Meeting : JICA Vietnam Office Meeting : Embassy of Japan Courtesy call : MARD/CERWASS Courtesy call : MP			←The Same left					←The Same left	Hanoi
3	2 June	Sat.		Site survey : Thanh Hoa			←The Same left					←The Same left	Thanh Hoa
4	3 June	Sun.	Arraival in Hanoi	Site survey : Ninh Binh			←The Same left					←The Same left	Hanoi
5	4 June	Mon.		Site survey : Thai Nguyen		Arraival in Hanoi		Site survey : Thai Nguyen			Arraival in Hanoi	Site survey : Thai Nguyen	Hanoi
6	5 June	Tue.					Meeting : CERWASS／Courtesy call : MARD						Hanoi
7	6 June	Wed.					Meeting : CERWASS						Hanoi
8	7 June	Thr.					Meeting : CERWASS						Hanoi
9	8 June	Fri.					Meeting : CERWASS						Hanoi
10	9 June	Sat.					Site survey : CERWASS' existing piped water supply systems nearby Hanoi						Hanoi
11	10 June	Sun.					Internal meeting						Hanoi
12	11 June	Mon.					Signing of M/D Report to JICA Vietnam Office Report to Embassy of Japan						Hanoi
13	12 June	Tue.	Leaving (13:55)	Leaving			Meeting : CERWASS (Ninh Binh)						Ninh Binh
14	13 June	Wed.			Site survey : (5) Donh Phong	Site survey : (6) Quang Son	Site survey : (5) Donh Phong	Site survey : (6) Quang Son		Site survey : (5) Donh Phong			Ninh Binh
15	14 June	Thr.					Site survey : (6) Quang Son						Ninh Binh
16	15 June	Fri.					Site survey : (7) Yen Thang						Hanoi
17	16 June	Sat.					Data abalysis						Hanoi
18	17 June	Sun.					Meeting : CERWASS (Thai Nguyen)						Hanoi
19	18 June	Mon.			Site survey : (1) Hoa Thurong	Site survey : (1) Hoa Thurong	Site survey : (1) Hoa Thurong	Site survey : (1) Hoa Thurong			Site survey : (1) Hoa Thurong		Hanoi
20	19 June	Tue.			Site survey : (2) Dong Bam	Site survey : (1) Hoa Thurong	Site survey : (2) Dong Bam	Site survey : (1) Hoa Thurong			Site survey : (2) Dong Bam		Hanoi
21	20 June	Wed.			Site survey : (3) Thinh Duc	Site survey : (2) Dong Bam	Site survey : (3) Thinh Duc	Site survey : (2) Dong Bam			Site survey : (3) Thinh Duc		Hanoi
22	21 June	Thr.			Site survey : (4) Nam Tien	Site survey : (3) Thinh Duc	Site survey : (4) Nam Tien	Site survey : (3) Thinh Duc			Site survey : (4) Nam Tien		Hanoi
23	22 June	Fri.			Meeting : CERWASS	Site survey : (4) Nam Tien	Meeting : CERWASS	Site survey : (4) Nam Tien		Meeting : CERWASS	Site survey : (4) Nam Tien		Hanoi
24	23 June	Sat.					Data abalysis						Hanoi
25	24 June	Sun.					Meeting : CERWASS (Thanh Hoa)						Thanh Hoa
26	25 June	Mon.			Site survey : (8) Vinh Thanh,(9) Vinh Loc	Site survey : (8) Vinh Thanh	Site survey : (8) Vinh Thanh,(9) Vinh Loc	Site survey : (8) Vinh Thanh			Site survey : (8) Vinh Thanh,(9) Vinh Loc		Thanh Hoa
27	26 June	Tue.			Site survey : (10) Dinh Turong	Site survey : (9) Vinh Loc	Site survey : (10) Dinh Turong	Site survey : (9) Vinh Loc			Site survey : (10) Dinh Turong		Thanh Hoa
28	27 June	Wed.			Site survey : (11) Va Ha Town	Site survey : (13) Van Thang	Site survey : (11) Va Ha Town	Site survey : (13) Van Thang			Site survey : (11) Va Ha Town		Thanh Hoa
29	28 June	Thr.			Site survey : (12) Thieu Do	Site survey : (12) Thieu Do	Site survey : (12) Thieu Do	Site survey : (12) Thieu Do			Site survey : (12) Thieu Do		Thanh Hoa
30	29 June	Fri.			Site survey : (13) Van Thang	Supplemental survey ／Data analysis	Site survey : (13) Van Thang	Supplemental survey ／Data analysis			Site survey : (13) Van Thang		Hanoi
31	30 June	Sat.					Data analysis／Internal meeting						Hanoi
32	1 July	Sun.					Data abalysis						Hanoi
33	2 July	Mon.					CERWASS／Supplemental survey／Additional data collection／Data analysis						Hanoi
34	3 July	Tue.					CERWASS／Supplemental survey／Additional data collection／Data analysis						Hanoi
35	4 July	Wed.			Leaving		CERWASS／Supplemental survey／Additional data collection／Data analysis						Hanoi
36	5 July	Thr.					CERWASS／Supplemental survey／Additional data collection／Data analysis						Hanoi
37	6 July	Fri.			The same ①	① Report to CERWASS Report to JICA Vietnam Office Additional data collection			② Supplemental survey Thai Nguyen No.4 Nam Tien	The same ①	The same ②		Hanoi
38	7 July	Sat.		The same right→			Preparation of Technical memorandum						Hanoi
39	8 July	Sun.		The same right→			Internal meeting/Technical memorandum						Hanoi
40	9 July	Mon.		The same right→			Leaving						

2. Explanation on Draft Report of Basic Design Study (December 2001)

	Date (2001)	Day	MOFA	JICA		Consultants					Stay in
			Noguchi Grant Aid Cooperation	Okubo Leader	Nishimura Coordinator	Yamazaki Chief Consultant	Ogura Water Supply Facility Planner	Hashimoto Socio-economy/ Operation and Maintenance Planner	Nakaoka Procurement Planner/ Cost Estimator	Shibata Equipment Planner	
1	9th December	Sun		Hanoi arrival / Internal meeting							Hanoi
2	10th December	Mon	Hanoi arrival	Visit: Embassy of Japan and JICA Vietnam Office Visit: MPI, MARD and CERWASS Discussion: MARD and CERWASS							Hanoi
3	11th December	Tue	Discussion: MARD and CERWASS								Hanoi
4	12th December	Wed	Field survey: Nam Tien, Thai Nguyen Province Discussion: MARD and CERWASS								Hanoi
5	13th December	Thr	Internal meeting			Explanation: CERWASS Data collection					Hanoi
6	14th December	Fri	Signing: M/D Reporting to: JICA Vietnam Office								Hanoi
7	15th December	Sat	Leaving Hanoi			Data collection and analysis					Hanoi
8	16th December	Sun				Internal meeting					Hanoi
9	17th December	Mon				Additional explanation: MPI and MARD					Hanoi
10	18th December	Tue				Field survey: Center for Material Delivery & Technology Transfer of CERWASS					Hanoi
11	19th December	Wed				Internal meeting Reporting to: Embassy of Japan and JICA Vietnam Office					Hanoi
12	20th December	Thr				Leaving Hanoi					

[Appendix -3] List of Officials Concerned

1. Basic Design Study (June - July 2001)

(1) Vietnamese Officials Concerned

- MARD (Ministry of Agriculture and Rural Development)

Nguyen Dinh Thinh	Vice Minister
Bui Thi Lan	Deputy Director, Int'l Cooperation Dept.
Dao Thi Loc	Expert, Int'l Cooperation Dept.
Dang Dinh Phuc	Manager, Groundwater Dept.
Nguyen Thanh Tung	Expert, Int'l Cooperation Dept.
Kumagai Toru	JICA Expert

- CERWASS (Center for Rural Water Supply and Environmental Sanitation)

Le Van Can	Director
Pham Duc Nam	Vice Director
Le Theiu Son	Vice Director
Ha Thang Hang	Vice Chief, Planning and Investment
Nguyen Thanh Luan	Director, Center for Material Delivery and Technology Transfer
Nguyen Son Tung	Hydrogeological Engineer, Technical Dept.
Le Quang Hung	Water Supply Engineer, Technical Dept.
Nguyen Ngoc Dao	Water Supply Engineer, Technical Dept.
Phan Dinh Phuc	Administration Dept.

- CERWASS, Thai Nguyen

Hoang Cuong Quoc	Director
Ngo Quang Tinh	Deputy Director
Dang Huy Thanh	Deputy Director
Vi Van Thu	Director, ARD

- CERWASS, Ninh Binh

Vo Duc Toan	Director
Hoang Van Suong	Deputy Director
Nguyen Van Thanh	Technician
Nguyen Xuan Nhan	Expert, Personnel and Administration Affairs Dept.
Dinh Van Bien	Deputy Director, ARD

- CERWASS, Thanh Hoa

Nguyen Van Cuong	Director
Nguyen Tho Long	Deputy Director
Tran Nam Chinh	Deputy Chief, Technical Planning Dept.

- MPI (Ministry of Planning and Investment)

Ho Quang Minh	Deputy Director General, FERD
Le Kieu	Senior Expert, Department of ARD

- UNICEF (United Nations Children's Fund)

  Chander Badloe Project Officer, Water and Sanitation Programme

- DANIDA (Danish International Development Assistance)

  Stephen Greenhalph Senior Technical Adviser, Water Sector Programme Support

- DPC (District Peoples Committee), Dong Hy, Thai Nguyen

  Kieu Thi Xuan Deputy Chairman PC, Dong Hy, Thai Nguyen

  Nguyen Thi Dung Director, ARD

- PC (Peoples Committee)

  Nguyen Ngoc Binh Chairman ofNo.1, Hoa Thurong, Thai Nguyen

  Nguyen Thi Thaivh Chairman of No.2, Dong Bam, Thai Nguyen

  Tran Minh Thaivh Chairman of No.3, Thinh Duc, Thai Nguyen

  Nguyen Van Tho Vice Chairman of No.4, Nam Tien, Thai Nguyen

  Bui Huy Phuong Chairman of No.5, Dong Phong, Ninh Binh

  Nguyen Van Ba Chairman of No.6, Quang Son, Ninh Binh

  Dinh Van Luu Chairman of No.7, Yen Thang, Ninh Binh

  Le Huu Ngoc Chairman of No.8, Vinh Thanh, Thanh Hoa

  Nguyen Van Hai Chairman of No.9, Vinh Loc, Thanh Hoa

  Trinh Huu Hien Chairman of No.10, Dinh Tuong, Thanh Hoa

  Hoang Hun Hien Chairman of No.11, Van Ha (Thieu Hung), Thanh Hoa

  Le Van Chi Chairman of Further Front Committee No.12, Thien Do, Thanh Hoa

  Le Thanh Quyer Chairman of No.13, Van Thang, Thanh Hoa

(2) Japanese Officials Concerned

- Embassy of Japan in Vietnam

  Kenji MIYAGAWA Second Secretary

- JICA Vietnam Office

  Morimasa KANAMARU Resident Representative

  Kouzou WATANABE Deputy Resident Representative

2. Explanation for Outline of Basic Design (December 2001)

(1) Vietnamese Officials Concerned

- MARD (Ministry of Agriculture and Rural Development)

Pham Xuan Su	Director General, Water Resources and Hydraulic Works Management Dept.
Dao Throng Tu	Deputy Director, Int'l Cooperation Dept.
Dao Thi Loc	Expert, Int'l Cooperation Dept.
Nguyen Ninh Tuan	Expert, Planning and Investment Dept.
Nguyen Thanh Tung	Expert, Int'l Cooperation Dept.

- CERWASS (Central for Rural Water Supply and Environmental Sanitation)

Le Van Can	Director
Le Theiu Son	Vice Director
Ha Van Mang	Vice Director, Chief, Planning and Investment
Ha Thang Hang	Vice Chief, Planning and Investment
Nguyen Thanh Luan	Director, Center for Material Delivery and Technology Transfer
Pham Anh Dung	Expert, Technical Division
Ha Duc Chinh	Hydrologist, Technical Transfer

- Provincial CERWASS

Hoang Cuong Qouc	Director, Thai Nguyen Province
Vo Duc Toan	Director, Ninh Binh Province
Nguyen Van Cuong	Director, Thanh Hoa Province

- MPI (Ministry of Planning and Investment)

Le Hong Thai	Director, Department of ARD
Ho Quang Minh	Deputy Director General, FERD
Nyugen Xuan Tien	Senior Expert, FERD
Le Kien	Senior Expert, Department of ARD

- PC (Peoples Committee)

Nguyen Trong Thut	Chairman of No.4, Nam Tien, Thai Nguyen
Nguyen Va Phung	Staff of No.4, Nam Tien, Thai Nguyen

(2) Japanese Officials Concerned

- Embassy of Japan in Vietnam

Kenji MIYAGAWA	First Secretary

- JICA Vietnam Office

Morimasa KANAMARU	Resident Representative
Masato TOGAWA	Senior Deputy Resident Representative
Hiroyuki KOBAYASHI	Deputy Resident Representative

[Appendix - 4] Minutes of Discussion

1. Basic Design Study (June - July 2001)

MINUTES OF DISCUSSIONS ON
THE BASIC DESIGN STUDY ON
THE GROUNDWATER DEVELOPMENT PROJECT
IN RURAL PART OF NORTHERN PROVINCES
IN THE SOCIALIST REPUBLIC OF VIETNAM

In response to a request from the Government of Socialist Republic of Vietnam (hereinafter referred to as "Vietnam"), the Government of Japan decided to conduct a Basic Design Study on THE GROUNDWATER DEVELOPMENT PROJECT IN RURAL PART OF NORTHERN PROVINCES (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Vietnam the Basic Design Study Team (hereinafter referred to as "the Team"), which was headed by Yoshiki OMURA, Senior Advisor, JICA. The Team is scheduled to stay in the country from May 31, 2001 to July 9, 2001.

The Team held discussions with the officials concerned of the Government of Vietnam and conducted a field survey at the study area.

In the course of discussions and field survey, both parties confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare the Basic Design Study Report.

Hanoi, June 11, 2001

Mr. Yoshiki OMURA
Leader
Basic Design Study Team
Japan International Cooperation Agency
Japan

Ms. Bui Thi Lan
Vice Director
International Cooperation Department
Ministry of Agriculture and Rural
Development (MARD)
Vietnam

Dr. Le Van Can
Director
Center for Rural Water Supply and
Environmental Sanitation (CERWASS)
Vietnam

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve water service conditions in rural part of northern provinces in order to increase public health and to upgrade living standards of inhabitants through groundwater development and construction of water supply systems.

2. Project sites

The Project sites are located in Ninh Binh, Thai Nguyen and Thanh Hoa Provinces.

3. Implementing Agency

The implementing agency is Center for Rural Water Supply and Environmental Sanitation (CERWASS), and the supervising agency is Ministry of Agriculture and Rural Development (MARD).

4. Items requested by the Government of Vietnam

The sites requested by Vietnamese side are listed in **Annex-I**. JICA will assess the appropriateness of the request and will recommend it to the Government of Japan for approval. However the component of the Project will be decided by the Government of Japan after further studies.

5. Japan's Grant Aid Scheme

The Vietnamese side understood the Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Vietnam as explained by the Team and described in **Annex-IV** and **Annex-V**.

6. Schedule of the Study

1) The Team will proceed to further studies in Vietnam until July 9, 2001.
2) JICA will prepare the draft report in English and dispatch a mission in order to explain its contents in October 2001.
3) In case that the contents of the report is accepted in principle by the Government of Vietnam, JICA will complete the final report and send it to the Government of Vietnam by January 2002.

7. Operation and Maintenance

1) Provincial CERWASS should be responsible for operation and maintenance of water supply systems constructed under the Project.
2) CERWASS should establish a water supply management unit for each water supply system for proper utilization. The unit is needed to manage the system such as collecting water charge from users and appropriating it for running cost of the system. CERWASS agreed to submit to the Japanese side a list of personnel in charge and the fund raising plan for the units by September 2001.
3) The Vietnamese side agreed to collect applications for water supply service from the residents in the proposed project communes to confirm the willingness to pay, and transfer them to the Japanese side by September 2001.

22

8. Other relevant issues

1) Both sides agreed that the target year would be 2005.
2) The Vietnamese side understood that the components, sizes, dimensions and locations of the requested facilities would be reviewed based on the study results in Japan.
3) The Japanese side informed that 13 communes would be covered by the Project, excluding two communes, Xuan Dinh and Dong Ngac, in Hanoi City. The Japanese side explained the reason of exclusion that two communes were located within the Hanoi City administrative boundary. It was noted that the Vietnamese side originally requested 15 communes for record purpose.
4) Both sides agreed the Project sites were to be examined on the selection criteria as listed in **Annex-II**. The Vietnamese side agreed that the Team would add factors to the criteria during further study.
5) Both sides agreed that the water supply facilities under the Project, in principle, consisted of deep tube well, water treatment facility, reservoir and distribution pipelines.
6) The Vietnamese side agreed that the water service level was determined based on the criteria shown in **Annex-III**. Both sides agreed that the Japanese side would construct distribution facility only up to branch saddle and stop valve on the service pipe, and the Vietnamese side was responsible for connection to households in case the individual house connection was introduced. The Vietnamese side requested provision of service pipe material including water meters to be covered under the Project.
7) The Vietnamese side agreed to be responsible to coordinate the Project among the projects by the other donors.
8) The Japanese side will present layouts of the proposed facilities for land acquisition needed for the implementation of the Project in October 2001. In accordance with the layouts, the government of Vietnam will complete land acquisition and compensation for property by March 2002. The Vietnamese side agreed to get the permission from the government of Vietnam for the detailed site survey by the Japanese side.
9) The Vietnamese side will secure the prompt and timely clearance of any governmental procedures required for the official approval of implementation of the Project by November 2001.
10) The Vietnamese side agreed that MARD would coordinate authorities concerned for securing tax exemption including VAT.
11) Both sides agreed to change the title of the Project to "THE GROUNDWATER DEVELOPMENT PROJECT IN RURAL PART OF NORTHERN PROVINCES IN THE SOCIALIST REPUBLIC OF VIETNAM".
12) Concerning the additional request by the Vietnamese side for equipment such as drilling rigs with supporting materials and construction of workshop, the Japanese side explained that provision of such equipment should be dealt with under a separate equipment supply project. However the Vietnamese side still insisted on further study of the request, the Japanese side mentioned that the Vietnamese side should submit a request with a detailed list of required items to the Japanese government for its consideration through the official channel.

Annex-I

PROJECT SITES REQUESTED BY THE GOVERNMENT OF VIETNAM

Province	District	Commune
Thai Nguyen	Dong Hy	Hoa Thuong
		Dong Bam
	Thai Nguyen Town	Thinh Duc
	Pho Yen	Nam Tien
Ninh Binh	Nho Quan	Dong Phong
	Tam Diep Town	Quang Son
	Yen Mo	Yen Thang
Thanh Hoa	Vinh Loc	Vinh Thanh
		Vinh Loc Town
	Yen Dinh	Dinh Tuong
	Thieu Hoa	Thieu Hung
		Thieu Do
	Nong Cong	Van Thang

Annex-II

CRITERIA FOR SELECTION OF THE PROJECT COMMUNES

1) Raw water quality of groundwater should meet the Vietnamese standard of "Standard 505 of Ministry of Health (Drinking and Domestic Water Quality Standard)", except iron, manganese and coliform, which can be removed by conventional methods. The Team in principle adopts water quality test items based on "TCXD 233:1999 (The Criteria for Groundwater Quality Evaluation as Water Source)".
2) Water production of wells as water source should meet water demand in the commune.
3) Justifiable construction cost per capita
4) Priority of the Project sites by the Vietnamese side
5) Development plans by the Vietnamese side in the Project sites are confirmed.
6) Operation and maintenance capability of water supply system
7) No apparent obstruction to land acquisition
8) Willingness to pay and affordability for monthly water charge
9) Water supply management unit should be established.
10) No existing similar water supply systems in the commune
11) No water supply project by other donors, which is existing, on-going or planned in future is located in the Project site.

Annex-III

CRITERIA FOR WATER SERVICE LEVEL DECISION

1) Affordability of bearing initial cost for individual house connection
2) Affordability of paying monthly water charge for individual house connection
3) Water demand of water users should be enough for individual house connection
4) Tested water production of wells should meet the estimated water demand.
5) Operation and maintenance capability of present water service conditions
6) Accessibility to present water source

55

Annex IV

JAPAN'S GRANT AID SCHEME

1. Grant Aid Procedures

(1) Japan's Grant Aid Program is executed through the following procedures.

Application	(Request made by a recipient country)
Study	(Basic Design Study conducted by JICA)
Appraisal & Approval	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of Implementation	(The Notes exchanged between the Governments of Japan and the recipient country)

(2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraises the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the results are then submitted to the Cabinet for approval.

Fourthly, the project, once approved by the Cabinet, becomes official with the Exchenge of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

(1) Contents of the Study

The aim of the Basic Design Study (hereinafter referred to as "the Study"), conducted by JICA on a requested project (hereinafter referred to as "the Project") is to provide a basic document necessary for the appraisal of the Project by the Japanese Government. The contents of the Study are as follows:

1) Confirmation of the background, objectives, and benefits of the requested project and also institutional capacity of agencies concerned of the recipient country necessary

for the Project's implementation.

2) Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, social and economical point of view.

3) Confirmation of items agreed on by both parties concerning the basic concept of the Project.

4) Preparation of a basic design of the Project.

5) Estimation of costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country through the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the Study is (are) recommended by JICA to the recipient country to also work in the Project's implementation after the Exchange of Notes, in order to maintain technical consistency.

3. Japan's Grant Aid Scheme

(1) Grant Aid

The Grant Aid Program provides a recipient country with non-reimbursable funds to procure facilities, equipment and services (engineering services and transportation of the products, etc.) for economic and social development of the country under principles in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

(2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes exchanged by the Governments concerned, in which the objectives of the Project, period of execution, conditions and amount of the Grant Aid, etc. are confirmed.

(3) "The period of the Grant Aid" means the one fiscal year which the Cabinet approves the Project for. Within the fiscal year, all procedures such as exchanging of the Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and a final payment to them must be completed.

However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year by mutual agreement between the two Governments.

(4) Under the Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When the two Governments deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country.

However the prime contractors, namely, consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality.)

(5) Necessity of "Verification"

The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

(6) Undertakings required of the Government of the Recipient Country

In the implementation of the Grant Aid project, the recipient country is required to undertake such necessary measures as the following:

1) To secure land necessary for the sites of the Project, and to clear, level and reclaim the land prior to commencement of the construction.

2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.

3) To secure buildings prior to the procurement in case the installation of the equipment.

4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of the products purchased under the Grant Aid.

5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.

6) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work.

7) Proper Use
The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

8) Re-export
The products purchased under the Grant Aid should not be re-exported from the recipient country.

9) Banking Arrangement (B/A)
(a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the verified contracts.

(b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

Annex-V

MAJOR UNDERTAKING TO BE TAKEN BY EACH GOVERNMENT

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land		●
2	To clear, level and reclaim the site when needed		●
3	To construct gates and fences in and around the site		●
4	To bear the following commissions to a bank of Japan for the banking services based upon the B/A		
	1) Advising commission of A/P		●
	2) Payment commission		●
5	To ensure prompt unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	●	
	2)Tax exemption and custom clearance of the products at the port of disembarkation		●
	3)Internal transportation from the port of disembarkation to the project site	●	
6	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contact such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		●
7	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contact		●
8	To maintain and use properly and effectively the facilities constructed and equipment provided under the Grant Aid		●
9	To bear all the expenses, other than those to be borne by the Grant Aid, necessary for construction of the facilities		●

2. Explanation on Draft Report of Basic Design (December 2001)

MINUTES OF DISCUSSIONS ON
THE BASIC DESIGN ON
THE PROJECT FOR THE GROUNDWATER DEVELOPMENT
IN RURAL PART OF NORTHERN PROVINCES
IN THE SOCIALIST REPUBLIC OF VIETNAM
(EXPLANATION ON DRAFT REPORT)

In June 2001, the Japan International Cooperation Agency (JICA) dispatched a Basic Design Study Team on the Project for the Groundwater Development in Rural Part of Northern Provinces (hereinafter referred to as "the Project") to the Socialist Republic of Vietnam (hereinafter referred to as "Vietnam"), and through discussions, field surveys, and technical examination of the results in Japan, JICA prepared a draft report of the study.

In order to explain and to consult Vietnam on the components of the draft report, JICA sent to Vietnam the Draft Report Explanation Team (hereinafter referred to as "the Team"), headed by Hisatoshi Okubo, Deputy Director, First Project Management Division, Grant Aid Management Department, JICA, from 9th December to 20th December, 2001.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Hanoi, 14th December, 2001

Mr. Hisatoshi Okubo
Leader
Draft Report Explanation Team
Japan International Cooperation Agency
Japan

Mr. Dao Trong Tu
Deputy Director
International Cooperation Department
Ministry of Agriculture and Rural Development (MARD)
Vietnam

Dr. Le Hong Thai
Director
Agriculture and Rural Development Department
Ministry of Planning and Investment (MPI)
Vietnam

Dr. Le Van Can
Director
Center for Rural Water Supply and Environmental Sanitation (CERWASS)
MARD
Vietnam

ATTACHMENT

1. Components of the Draft Report

The Vietnamese side agreed and accepted in principle the components of the draft report explained by the Team.

2. Components of the Project

The components of the Project, consisting of construction of facilities and procurement of equipment and materials, are summarized in **Annex I** and **II** respectively. However, the final components are subject to the official decision of the cabinet of Japan.

3. Japan's Grant Aid Scheme

The Vietnamese side reconfirmed and understood Japan's Grant Aid Scheme and the necessary measures to be taken by the Government of Vietnam as explained by the Team and described in Annex IV and Annex V of the Minutes of Discussions signed by both sides on 11th June, 2001.

4. Schedule of the Study

(1) The consultants will proceed to conduct further studies in Vietnam until 20th December, 2001.

(2) JICA will complete the final report and send it to the Government of Vietnam around March 2002.

5. Water Supply Systems

A typical water supply system in each commune to be constructed under the Project consists of the followings:

(a) deep well
(b) submersible intake pump
(c) pump house
(d) raw water transmission
(e) treatment plant
(f) chlorination
(g) reservoir
(h) distribution pump

(i) elevated tank
(j) distribution pipeline
(k) block service pipe
(l) house-connection service pipe
(m) water meter

Among the above facilities, designs and specifications of treatment plants have been determined according to water quality of deep groundwater. Out of 11 water supply systems, 6 require treatment plants targeting at removal of iron, manganese or both as in **Annex I**.

The exclusion of Thieu Do was decided due to the high concentration of ammonia in the groundwater. Having facilities to remove ammonia is technically possible but financially not feasible.

6. Supply of Equipment and Materials

As described in **Annex II**, supply of well drilling equipment and materials for individual household connections is included in the Project. For the implementation period of the Project (i.e. duration of E/N validity), a Japanese contractor will exclusively use the drilling equipment and other machinery for construction of deep tube wells for the Project.

Water meters, block service pipes and house-connection service pipes are supplied for the Vietnamese side to complete individual household connections. It is the responsibility of the Vietnamese side to finish all the household connections for the Project within the Project implementation period (E/N duration) without delay.

7. Work Items to be Implemented by the Vietnamese Side

(1) The Vietnamese side is responsible for implementations of work items described in **Annex III**. The required budget for the cost will also be borne by the Vietnamese side. Concerning the work items by the Vietnamese side, the Project covers only procurement of pipes and water meters as explained in the above Articles 5 and 6.

(2) After completion of the Project, proper operation and maintenance (O/M) of the supply systems are of utmost importance. The Vietnamese side will conduct the proper O/M activities as listed in **Annex IV**.

8. Coordination

From the preparation stage through implementation (i.e. construction) to operation and maintenance (O/M), the Project inevitably requires complex and challenging

coordination among relevant Vietnamese authorities. CERWASS, as an implementing agency, has to play a pivotal role in such coordination, both administrative and managerial, under the supervision of MARD.

Citing example of other water supply system projects where lack of coordination caused delays in implementation, the Japanese side requested the Vietnamese side to achieve attentive and careful coordination particularly towards realization of Article 7 ("Operation and Maintenance") in the Minutes of Discussions (11th June, 2001).

In this regard, the Project Management Unit (PMU) should be established at the central level and the Water Management Unit (WMU) at provincial levels.

9. Modification of Design

Designs, specifications and capacities of water supply systems of the Project have been prepared based on the best and most accurate technical data collected and available during the Basic Design study period. In any groundwater development project, however, water quality and quantity will be finally confirmed only at a construction stage, thus making modification of facility design sometimes inevitable. Such modification, if necessary, will be made based strictly on guidelines of the Japan's Grant Aid Scheme.

10. Other Relevant Issues

(1) Both sides reconfirmed all the articles and items recorded in the Minutes of Discussions signed on 11th June, 2001.

(2) The Vietnamese side shall exempt Japanese juridical and physical nationals engaged in the Project from customs duties, internal taxes including VAT, and other fiscal levies which may be imposed in Vietnam regarding the supply of products and services under the verified contracts.

(3) The Vietnamese side shall obtain the official appraisal and approval of the implementation of the Project by the Government of Vietnam not later than the middle of February, 2002.

(4) The Vietnamese side will continue to collect from residents in the communes applications for water supply service together with confirmation of willingness to pay for the service and submit them to the Japanese side by the end of December,

2001.

(5) The Vietnamese side strongly requested that Van Ha (Thieu Hung) planned for the third stage of the Project in the draft report should be included in the first stage of implementation. According to the explanation by the Vietnamese side, the Minister for MARD issued a directive in April 2001 concerning establishment of 12 model rural development pilot communes in the country. Van Ha has been selected as one of the 12 communes and currently is required by the Government to develop a plan of infrastructure modernization. The construction of water supply system in the commune under the Project is already part of its modernization plan in Van Ha. Early implementation of Van Ha under the Project is thus necessary.

The Japanese side understood the situation regarding Van Ha but also noted that inclusion of Van Ha in the first stage of the Project would increase the total Project budget borne by the Japanese side owing to increase of indirect construction and overhead costs. However, the Team will convey the request by the Vietnamese side to the Japanese authorities for further examination and will inform the Vietnamese side of the result by the end of December, 2001.

Annex I. Main Components of the Water Supply Systems

Province	Commune	Service Population (person)	Number of House Connection (house)	Number of Existing Deep Well (No.)	Number of Additional Deep Well (No.)	Water Treatment Plant			Distribution Pipelines (m)
						Iron removal	Manganese removal	Chlorination	
Thai Nguyen	No.1 Hoa Thuong	7,760	1,850	1	0	√	√	√	17,910
	No.2 : Dong Bam	6,020	1,940	0	1	√	√	√	14,180
	No.3 : Thinh Duc	3,457	830	1	2	-	-	√	6,650
	No.4 : Nam Tien	4,518	1,080	1	4	-	√	√	13,490
Ninh Binh	No.5 : Dong Phong	9,890	2,360	1	0	-	-	√	18,070
	No.6 : Quang Son	5,090	1,220	1	2	-	-	√	9,310
	No.7 : Yen Thang	8,790	2,100	0	3	-	-	√	12,120
Thanh Hoa	No.8 & 9 : Vinh Thanh & Vinh Loc	13,000	3,150	1	0	-	√	√	13,520
	No.10 : Dinh Tuong	6,360	1,520	1	0	√	√	√	6,960
	No.11 : Van Ha (Thieu Hoa)	7,272	1,730	1	0	-	√	√	10,910
	No.13 : Van Thang	3,230	770	1	1	-	-	√	6,330
Total		Persons 75,387	Houses 18,680	Wells 9	Wells 13	Plants 11			m 122,490

Annex II. List of Equipment and Materials to be Supplied

Component	Item	Content	Quantity
A. Well Drilling Equipment	(1) Well drilling equipment	1) Well drilling rig 2) Tools for drilling/fishing and casing 3) High-pressure air compressor 4) Air lifting equipment 5) Accessories	1 unit / lot each
	(2) Supporting equipment	1) Cargo truck with crab-back crane 2) Pumping test equipment 3) Well logging equipment	1 unit / set / lot each
	(3) Workshop equipment	1) Workshop equipment	1 lot
	(4) Spare parts	1) Spare parts for the aboves	1 lot
B. Materials	(1) Block service pipe	1) Polyethylene pipe (OD = 40 mm) 2) Branch-Tee (40 mm x 20 mm)	1 lot
	(2) House connection materials	1) Water meter (ND = 13 mm)	18,000 pieces
		2) Polyethylene pipe (OD = 20 mm)	1 lot
	(3) Well pump	1) Submersible intake pump for standby purpose	7 sets

Note: OD = Outer diameter
ND = Nominal diameter

Annex III. Work Items to be Implemented by the Vietnamese Side

No.	Work Items
(1)	Land acquisition and development work (For wells, treatment facilities and reservoirs)
(2)	Access roads construction (To the above construction sites)
(3)	Temporary land use (For temporary storage and use of the contractor's works during construction period. Land rental.)
(4)	Public electricity supply works (To wells and treatment facilities)
(5)	Drainage works (Drainage from treatment facilities to outsides)
(6)	Construction of gates and fences (In sites of wells, treatment facilities and reservoirs)
(7)	Installation work of "Block Service Pipes" (Pipes: OD 40mm of PE and Branch-Tee to be supplied by the Grant Aid)
(8)	Installation work of "House Connection Service Pipes" (Water meters and 20 mm PE pipes (20 m long each house) to be supplied by the Grant Aid)

Annex IV. Operation and Maintenance to be Implemented by the Vietnamese Side

No.	Items
(1)	Personnel
(2)	Chemicals
(3)	Electricity
(4)	Repairs
(5)	Others

[Appendix - 5] Cost Estimation Borne by the Vietnam Government

Work items and the their costs tentatively estimated (Total : US$ 1,448,865) to be borne and financed by the Vietnamese side is summarized below:

Estimated Costs to be Borne and Financed by Vietnam Side

No.	Work Item	Amount (US$)
(1)	Land acquisition (For wells, treatment facilities and reservoirs)	$183,862
(2)	Land development work (For the above)	$78,966
(3)	Access roads construction (To the above construction sites)	$16,437
(4)	Temporary land use (For temporary storage and use of the contractor's works during construction period. Land rental.)	$67,261
(5)	Public electricity supply works (To wells and treatment facilities)	$156,143
(6)	Drainage works (Drainage from treatment facilities to outsides)	$39,517
(7)	Construction of gates and fences (In sites of wells, treatment facilities and reservoirs)	$46,552
(8)	Installation work of "Block Service Pipes" (Pipes: OD 40mm of PE and Branch-Tee to be supplied by the Grant Aid)	$493,647
(9)	Installation work of "House Connection Service Pipes" (Water meters and 20 mm PE pipes (20 m long each each house) to be supplied by the Grant Aid)	$366,480
Total		US$ $1,448,865

Exchange rates : US$ 1.00 = Japanese Yen 123.46 = VND 14,732

VND 1.00 = Japanese Yen 0.0084

Costs by Commune and Province (Unit: US$)

Province	No.	Commune	(1) Land Acqui-sition	(2) Land Develop-ment	(3) Access Roads	(4) Land Rental	(5) Elect-ricity
Thai Nguyen	No.1	Hoa Thuong	19,657	8,901	1,764	0	10,060.0
	No.2	Dong Bam	17,376	6,953	649	7,237	13,223.0
	No.3	Thinh Duc	19,331	17,061	5,219	11,280	17,004.0
	No.4	Nam Tien	16,833	7,034	666	0	29,595.0
	Sub-total		73,197	39,948	8,298	18,517	69,882.0
Ninh Binh	No.5	Dong Phong	15,204	2,237	74	8,555	7,277.0
	No.6	Quang Son	15,476	3,621	454	11,645	12,863.0
	No.7	Yen Thang	10,046	9,227	7,368	0	27,966.0
	Sub-total		40,726	15,086	7,896	20,200	48,106.0
Thanh Hoa	Nos.8 & 9	Vinh Thanh & Vinh Loc	20,634	2,968	12	11,869	7,636.0
	No.10	Dinh Tuong	17,105	6,456	142	0	9,639.0
	No.11	Van Ha	18,571	12,996	23	7,639	7,277.0
	No.13	Van Thang	13,629	1,512	66	9,036	13,603.0
	Sub-total		69,939	23,932	243	28,544	38,155.0
Total			183,862	78,966	16,437	67,261	156,143.0

Province	No.	Commune	(6) Drain-age	(7) Gate and Fence	(8) Block Service Pipeline	(9) House Connec-tion	Total (1+2+3+ 4+5+6+ 7+8+9) (US$)
Thai Nguyen	No.1	Hoa Thuong	3,802	3,912	75,108	37,666	160,870
	No.2	Dong Bam	5,975	4,279	53,724	29,318	138,734
	No.3	Thinh Duc	0	6,691	26,730	16,899	120,215
	No.4	Nam Tien	8,827	7,329	50,622	21,989	142,895
	Sub-total		18,604	22,211	206,184	105,872	562,713
Ninh Binh	No.5	Dong Phong	0	2,675	55,341	48,050	139,413
	No.6	Quang Son	1,901	4,506	37,158	24,839	112,463
	No.7	Yen Thang	0	4,886	39,666	42,756	141,915
	Sub-total		1,901	12,067	132,165	115,645	393,792
Thanh Hoa	Nos.8 & 9	Vinh Thanh & Vinh Loc	2,173	3,073	52,701	63,116	164,182
	No.10	Dinh Tuong	11,407	2,828	39,138	30,947	117,662
	No.11	Van Ha	2,716	2,920	43,560	35,223	130,925
	No.13	Van Thang	2,716	3,453	19,899	15,677	79,591
	Sub-total		19,012	12,274	155,298	144,963	492,360
Total			39,517	46,552	493,647	366,480	1,448,865

< Breakdown (1) >

Land Acquisition

Commune No.	Land area for wells isolated (m2)	(m x m)	Land area for treatment, reservoir and elevated tank (m2)	(m x m)	Total land area (m2)	Unit price of land (US$/m2)	Amount (US$)
No.1	100	(10 x 10) x 1sites	1,710	(45 x 38)	1,810	10.86	19,657
No.2	100	(10 x 10) x 1sites	1,500	(40 x 35)+(10 x 10)	1,600	10.86	17,376
No.3	300	(10 x 10) x 3 sites	1,480	(25 x 28)+(30 x 26)	1,780	10.86	19,331
No.4	500	(10 x 10) x 5 sites	1,050	(35 x 30)	1,550	10.86	16,833
No.5	0		1,400	(40 x 35)	1,400	10.86	15,204
No.6	200	(10 x 10) x 2sites	1,225	(35 x 35)	1,425	10.86	15,476
No.7	300	(10 x 10) x 3sites	625	(25 x 25)	925	10.86	10,046
Nos. 8&9	0		1,900	(50 x 38)	1,900	10.86	20,634
No.10	0		1,575	(45 x 35)	1,575	10.86	17,105
No.11	0		1,710	(45 x 38)	1,710	10.86	18,571
No.13	100	(10 x 10) x 1sites	1,155	(35 x 33)	1,255	10.86	13,629
Total	1,600		15,330		16,930		183,862

- Unit price assumed for land acquisition = 160,000 VND/m2 = 10.86 $/m2

< Breakdown (2) >

Land Development Work

Commune No.	Work item	Work volume (m3)					Unit price $/m3	Amount (US$)
		Wells site		Facilities site		Total volume		
		Area	Volume	Area	Volume			
No.1	Excavation	100	0	1,710	1,642	1,642	2.41	3,957
	Banking	100	336	1,710	286	622	3.80	2,364
	Soil disposal	100	0	1,710	1,358	1,358	1.90	2,580
	Sub-total							8,901
No.2	Excavation	100	0	1,500	258	258	2.41	622
	Banking	100	575	1,500	1,091	1,666	3.80	6,331
	Soil disposal	100	0	1,500	0	0	1.90	0
	Sub-total							6,953
No.3	Excavation	300	0	1,480	1,715	1,715	2.41	4,133
	Banking	300	2,148	1,480	793	2,941	3.80	11,176
	Soil disposal	300	0	1,480	922	922	1.90	1,752
	Sub-total							17,061
No.4	Excavation	500	0	1,050	0	0	2.41	0
	Banking	500	1,185	1,050	666	1,851	3.80	7,034
	Soil disposal	500	0	1,050	0	0	1.90	0
	Sub-total							7,034
No.5	Excavation	0	0	1,400	0	0	3.05	0
	Banking	0	0	1,400	578	578	3.87	2,237
	Soil disposal	0	0	1,400	0	0	2.38	0
	Sub-total							2,237
No.6	Excavation	200	39	1,225	0	39	3.05	119
	Banking	200	269	1,225	636	905	3.87	3,502
	Soil disposal	200	0	1,225	0	0	2.38	0
	Sub-total							3,621
No.7	Excavation	300	189	625	1,420	1,609	3.05	4,907
	Banking	300	243	625	0	243	3.87	940
	Soil disposal	300	0	625	1,420	1,420	2.38	3,380
	Sub-total							9,227
Nos. 8 & 9	Excavation	0	0	1,900	0	0	2.52	0
	Banking	0	0	1,900	781	781	3.80	2,968
	Soil disposal	0	0	1,900	0	0	1.90	0
	Sub-total							2,968
No. 10	Excavation	0	0	1,575	0	0	2.52	0
	Banking	0	0	1,575	1,699	1,699	3.80	6,456
	Soil disposal	0	0	1,575	0	0	1.90	0
	Sub-total							6,456
No. 11	Excavation	0	0	1,710	0	0	2.52	0
	Banking	0	0	1,710	3,420	3,420	3.80	12,996
	Soil disposal	0	0	1,710	0	0	1.90	0
	Sub-total							12,996
No.13	Excavation	100	0	1,155	0	0	2.52	0
	Banking	100	43	1,155	355	398	3.80	1,512
	Soil disposal	100	0	1,155	0	0	1.90	0
	Sub-total							1,512
Total								US$ 78,966

< Breakdown (3) >

Access Roads Construction

Commune No.	Work item	Work volume (m3)					Unit price $/m3	Amount (US$)
		Well site		Facilities site		Total volume		
		Length	Volume	Length	Volume			
No.1	Excavation	20	0	150	80	80	2.41	193
	Banking	20	0	150	270	270	3.80	1,026
	Soil disposal	20	0	150	0	0	0.00	0
	Gravel work	20	0	150	134	134	4.07	545
	Sub-total							1,764
No.2	Excavation	300	0	60	0	0	2.41	0
	Banking	300	134	60	24	158	3.80	600
	Soil disposal	300	0	60	0	0	0.00	0
	Gravel work	300	6	60	6	12	4.07	49
	Sub-total							649
No.3	Excavation	50	0	70	825	825	2.41	1,988
	Banking	50	247	70	433	680	3.80	2,584
	Soil disposal	50	0	70	392	392	0.00	0
	Gravel work	50	12	70	147	159	4.07	647
	Sub-total							5,219
No.4	Excavation	120	0	330	0	0	2.41	0
	Banking	120	136	330	5	141	3.80	536
	Soil disposal	120	0	330	0	0	0.00	0
	Gravel work	120	30	330	2	32	4.07	130
	Sub-total							666
No.5	Excavation	0	0	20	0	0	3.05	0
	Banking	0	0	20	14	14	3.87	54
	Soil disposal	0	0	20	0	0	0.00	0
	Gravel work	0	0	20	5	5	4.07	20
	Sub-total							74
No.6	Excavation	60	0	30	0	0	3.05	0
	Banking	60	47	30	3	50	3.87	194
	Soil disposal	60	0	30	0	0	0.00	0
	Gravel work	60	63	30	1	64	4.07	260
	Sub-total							454
No.7	Excavation	90	0	920	1860	1860	3.05	5,673
	Banking	90	28	920	0	28	3.87	108
	Soil disposal	90	0	920	1860	1860	0.00	0
	Gravel work	90	18	920	372	390	4.07	1,587
	Sub-total							7,368
Nos. 8 & 9	Excavation	0	0	30	0	0	2.52	0
	Banking	0	0	30	2	2	3.80	8
	Soil disposal	0	0	30	0	0	0.00	0
	Gravel work	0	0	30	1	1	4.07	4
	Sub-total							12
No. 10	Excavation	0	0	180	0	0	2.52	0
	Banking	0	0	180	31	31	3.80	118
	Soil disposal	0	0	180	0	0	0.00	0
	Gravel work	0	0	180	6	6	4.07	24
	Sub-total							142
No. 11	Excavation	0	0	20	0	0	2.52	0
	Banking	0	0	20	4	4	3.80	15
	Soil disposal	0	0	20	0	0	0.00	0
	Gravel work	0	0	20	2	2	4.07	8
	Sub-total							23
No.13	Excavation	300	0	120	0	0	2.52	0
	Banking	300	9	120	1	10	3.80	38
	Soil disposal	300	0	120	0	0	0.00	0
	Gravel work	300	6	120	1	7	4.07	28
	Sub-total							66
Total								US$ 16,437

< Breakdown (4) >

Lands for Temporary Use

Commune No.	Land Required	Total land area (m2)	Unit cost	Amount US$
No.1	0	0	1.358	0
No.2	(73 m x 73 m)	5,329	1.358	7,237
No.3	(86 m x 86 m) + (35 m x 26 m)	8,306	1.358	11,280
No.4	0	0	1.358	0
No.5	(70 m x 70 m) + (40 m x 35 m)	6,300	1.358	8,555
No.6	(100 m x 70 m) + (45 m x 35 m)	8,575	1.358	11,645
No.7	0	0	1.358	0
Nos. 8 & 9	(90 m x 76 m) + (50 m x 38 m)	8,740	1.358	11,869
No.10	0	0	1.358	0
No.11	(75 m x 75 m)	5,625	1.358	7,639
No.13	(72 m x 72 m) + (42 m x 35 m)	6,654	1.358	9,036
Total		49,529		67,261

- Unit price of temporary land use cost = 20,000 VND/m2 = 1.358 US$/m2

< Breakdown (5) >:

Electricity Supply Works

(5)-1 Electricity Supply Works for Treatment Facilities and Reservoirs

Commune No.	Power Supply (kw)	Cost of Panel	Cost of Trans-former	Electric Pole		Cable				Total	
				No.	Mil. VND	Size (mm2)	L (m)	Unit Price 1,000 . VND	Mil VND	Mil VND	US$
		Mil VND (A)	Mil VND (B)		(C)				(D)	A+B+C+D	
No.1	10.5	9	39	7	28	14	170	60	10.2	86.2	5,851
No.2	10.5	9	39	4	16	14	80	60	4.8	68.8	4,670
No.3-n	4.7	9	39	3	12	8	50	50	2.5	62.5	4,242
No.3-s	4.7	9	39	3	12	8	60	50	3.0	63.0	4,276
No.4	7.0	9	39	13	52	14	350	60	21.0	121.0	8,213
No.5	21.5	9	39	2	8	32	40	80	3.2	59.2	4,018
No.6	12.2	9	39	3	12	22	50	70	3.5	63.5	4,310
No.7	1.0	9	39	32	128	8	940	50	47.0	223.0	15,137
Nos. 8 & 9	36.5	9	39	3	12	50	50	90	4.5	64.5	4,378
No.10	14.2	9	39	8	32	22	200	70	14.0	94.0	6,381
No.11	21.5	9	39	2	8	32	40	80	3.2	59.2	4,018
No.13	10.2	9	39	6	24	14	140	60	8.4	80.4	5,458
Grand total										1045.3	70,952

- Panel : For 50 kVA
- Transformer : For 50 kVA
- Unit price of an electric pole = 4,000,000 VND

(5)-2 Electricity Supply Works for Wells Isolated

Commune No.		Power Supply (kw)	Cost of Panel Mil VND (A)	Cost of Trans-former Mil VND (B)	Electric Pole No.	Electric Pole Mil. VND (C)	Cable Size mm2	Cable Length (m)	Cable Unit Price 1,000 . VND	Cable Mil VND (D)	Total Mil VND A+B+C+D
No.1		7.5	9	39	3	12	14	40	60	2	62
No.2		11.0	9	39	14	56	22	320	70	22	126
No.3	W2	1.5	9	39	3	12	8	50	50	3	63
	W3	1.5	9	39	3	12	8	40	50	2	62
No.4	J3	1.5	9	39	3	12	8	50	50	3	63
	W1	2.2	9	39	3	12	8	50	50	3	63
	W2	2.2	9	39	3	12	8	50	50	3	63
	W3	2.2	9	39	3	12	8	50	50	3	63
	W4	2.2	9	39	3	12	8	50	50	3	63
No.5		0.0	9	39	0	0	0	0	0	0	48
No.6	W1	3.7	9	39	3	12	8	50	50	3	63
	W2	3.7	9	39	3	12	8	50	50	3	63
No.7	W1	3.7	9	39	3	12	8	50	50	3	63
	W2	3.7	9	39	3	12	8	50	50	3	63
	W3	3.7	9	39	3	12	8	50	50	3	63
Nos. 8 & 9		0.0	9	39	0	0	0	0	0	0	48
No.10		0.0	9	39	0	0	0	0	0	0	48
No.11		0.0	9	39	0	0	0	0	0	0	48
No.13		3.7	9	39	14	56	8	320	50	16	120
Total											1,255 Mil VND = USD 85,189

- Panel : For 50 kVA
- Transformer : For 50 kVA
- Unit price of an electric pole = 4,000,000 VND

(5)-3 Total Costs for Electricity Supply

Commune No.	(1) For Facilities Mil VND	(2) For Wells Mil VND	(1)+(2) Total Mil VND	(1)+(2) Total US$
No.1	86.2	62.0	148.2	10,060
No.2	68.8	126.0	194.8	13,223
No.3	125.5	125.0	250.5	17,004
No.4	121.0	315.0	436.0	29,595
No.5	59.2	48.0	107.2	7,277
No.6	63.5	126.0	189.5	12,863
No.7	223.0	189.0	412.0	27,966
Nos. 8 & 9	64.5	48.0	112.5	7,636
No.10	94.0	48.0	142.0	9,639
No.11	59.2	48.0	107.2	7,277
No.13	80.4	120.0	200.4	13,603
	Mil VND	Mil VND	Mil VND	US$
Total	1,045.3	1,255.0	2,300.3	156,143.0

< Breakdown (6) >

Drainage Works

Commune No.	Distance of drainage pipeline from treatment facilities to outside	Unit cost US$/m	Amount US$
No.1	280	13.58	3,802
No.2	440	13.58	5,975
No.3	0	13.58	0
No.4	650	13.58	8,827
No.5	0	13.58	0
No.6	140	13.58	1,901
No.7	0	13.58	0
Nos. 8 & 9	160	13.58	2,173
No.10	840	13.58	11,407
No.11	200	13.58	2,716
No.13	200	13.58	2,716
Total	2,910		39,517

- Drain pipes : 50 mm dia. PVC pipes

< Breakdown (7) >

Construction of Gates and Fences

Commune No.	Gate				Fence						Total Amount
	For Facilities (Nos.)	For wells (Nos.)	Total (Nos.)	US$	For Facilities (m)	(Formation)	For Wells (m)	(Formation)	Total (m)	US$	(US$)
No.1	1	1	2	760	166	(45 x 38)	40	(10 x 10) x 1sites	206	3,152	3,912
No.2	1	1	2	760	190	(40 x 35)+(10 x 10)	40	(10 x 10) x 1sites	230	3,519	4,279
No.3	2	2	4	1,520	218	(25 x 28)+(30 x 26)	120	(10 x 10) x 3 sites	338	5,171	6,691
No.4	1	5	6	2,280	130	(35 x 30)	200	(10 x 10) x 5 sites	330	5,049	7,329
No.5	1	0	1	380	150	(40 x 35)	0	0	150	2,295	2,675
No.6	1	2	3	1,140	140	(35 x 35)	80	(10 x 10) x 2sites	220	3,366	4,506
No.7	1	3	4	1,520	100	(25 x 25)	120	(10 x 10) x 3sites	220	3,366	4,886
Nos. 8 & 9	1	0	1	380	176	(50 x 38)	0	0	176	2,693	3,073
No.10	1	0	1	380	160	(45 x 35)	0	0	160	2,448	2,828
No.11	1	0	1	380	166	(45 x 38)	0	0	166	2,540	2,920
No.13	1	1	2	760	136	(35 x 33)	40	(10 x 10) x 1sites	176	2,693	3,453
Total											US$ 46,552

- Unit price of a gate construction : 380 $/No.
- Unit price of fence construction : 15.3 $/m

< Breakdown (8) >

Installation of "Block Service Pipes"

Commune No.	Length of "Block Service Pipeline"	Unit cost (US$/m)	Amount US$
No.1	22,760 m	3.3	75,108
No.2	16,280 m	3.3	53,724
No.3	8,100 m	3.3	26,730
No.4	15,340 m	3.3	50,622
No.5	16,770 m	3.3	55,341
No.6	11,260 m	3.3	37,158
No.7	12,020 m	3.3	39,666
Nos. 8 & 9	15,970 m	3.3	52,701
No.10	11,860 m	3.3	39,138
No.11	13,200 m	3.3	43,560
No.13	6,030 m	3.3	19,899
Total	149,590 m		US$ 493,647

Note: Installation work of "Block Service Pipes" to be done by the Vietnam side shall include, but not limited to, procurement of other materials than that the Grant Aid's supply (See *1); and all installation works.

(*1) : The Grant Aid Scheme will supply the following:
- PE pipes (OD: 40 mm) = 149,590 m in total for 12 communes of 11 systems
- Tee-branch (40 mm x 20 mm) = 18,000 Nos. in total for 12 communes of 11 systems

Breakdown (9) >

Installation of "House Connection Service Pipes"

Commune No.	Number of Household to be Connected	Unit cost (US$/household)	Amount US$
No.1	1,850 Nos.	20.36	37,666
No.2	1,440 Nos.	20.36	29,318
No.3	830 Nos.	20.36	16,899
No.4	1,080 Nos.	20.36	21,989
No.5	2,360 Nos.	20.36	48,050
No.6	1,220 Nos.	20.36	24,839
No.7	2,100 Nos.	20.36	42,756
Nos. 8 & 9	3,100 Nos.	20.36	63,116
No.10	1,520 Nos.	20.36	30,947
No.11	1,730 Nos.	20.36	35,223
No.13	770 Nos.	20.36	15,677
Total	18,000 Nos.		366,480

- Unit cost of installation work = 300,000 VND/household = 20.36 US$/household

Note : Installation work of "house connection service pipes" to be done by the Vietnam side shall include, but not limited to, procurement of other materials than that the Grant Aid's supply (See *2); and all installation works.

(*2) : The Grant Aid Scheme will supply the following:
- Water meter (ND: 13 mm) = 18,000 Nos. in total
- PE pipes (OD: 20 mm) = 360,000 m (18,000 houses x 20 m each = 360,000 m) in total

[Appendix – 6] Result of Baseline Survey

Result of Baseline Survey of Thai Nguyen Province

	Commune Name	Hoa Thuong	Dong Bam	Thinh Duc	Nam Tien
	Commune No.	No. 1	No. 2	No. 3	No. 4
A. Province/District information	Unit				
1) Name of concerned Province	-	Thai Nguyen			
2) Center of concerned Province	-	Thai Nguyen City			
3) Population of the Province	person	-			
4) No. of District in the province	-	-			
5) No. of communes in the province	-	-			
6) Name of the concerned district	-	Dong Hy		Thai Nguyen Town	Pho Yen
7) Population of the district	person	11,000		-	-
8) No. of communes in the district	-	20		-	-
B. General condition					
1) No. of villages	-	16	10	25	11
2) Population (pop.)	person	10,000	5,445	6,500	6,500
3) Area (total)	km2	13.55	4.01	18.37	9.3
4) Area (residential)	km2	0.91	0.433	0.457	3.3
5) Pop. density (total area)	pop./ha	7	14	4	7
6) Pop. density (residential area)	pop./ha	110	126	142	20
7) Pop. Increasing ratio	%	1,2	0.7	1.2	1.5
8) No. of households (total area)	hh	2,415	1,311	1,547	1,500
C. Natural condition					
1) Rainfall	mm	-	-	-	-
2) Elevation at commune PC	m	-	-	-	-
D. Social Condition					
1) Pop. of Ave. household	person/hh	4	4.15	4	4.3
2) Pop. ratio (adult/child)	%	60.5/39.5	72.7/27.3	72/28	70/30
3) Pop. ratio (male/female)	%	-	50/50	48/52	48/52
4) Ratio of disease	%	20.3	39.7	5	95
5) Infant mortality rate(U14MR)	%	-	8	10	5
6) Under 5 mortality rate (U5MR)	%	-	3	5	4
7) Main product	-	Agriculture(80 %)	Agriculture(70 %)	Rice	Agriculture
8) Income of household	VND/hh/M	625,000	1,000,000	130,000	500,000
9) Medical payment	VND/hh/M	50,000	10,000	20,000	30,000
10) Electricity charge	VND/hh/M	45,000	30,000	15,000	20,000
11) School attendance rate (Primary school)	%	100	100	100	100
12) School attendance rate (Secondary school)	%	98	98	95	99.9
13) School attendance rate (High school)	%	55.8	80	80	50
14) School attendance rate (Over high school)	%	14	20	10	3
E. Accessibility					
1) Distance between capital of province and the commune	km	7	2	10	30
2) Access way	-	Good	Good	Good	Soil road
3) Traveling time	minutes	20	5	30	30
F. Existing infrastructure					
1) Road length	km	13	15	30	15
2) Ratio of pavement	%	0	0	Soil road	0
3) Covered ratio of electricity service	%	100	100	95	98
4) Condition of solid waste management	-	-	-	-	-
G. Existing condition on water supply					
1) Existence of water facilities in household	-	Dug well	Dug well	Dug well	Dug well
2) Ratio of water sources (private dug well. private tub well. public well. others)	-	80% use dug well	95% use dug well	100% private dug well	-
3) Distance between house and water source	m	-	20	15	10
4) Water consumption rate	L/hh/d	250	-	320	260
5) Condition in rainy season	-	80% has water	-	100% has water	Enough Qty.. bad quality
6) Condition in dry season	-	40% has water	-	50% has water	30% has water
H. Consciousness on new water supply					
1) Request of service level (house connection/public stand pipe)	-	house connection	house connection	95%house connection	house connection
2) No. of household to be covered by the water supply project	%	80	100	80	90
3) Willingness to connect by household	%	-	-	95	100
4) Affordability of paying house connection fee by household	VND/hh	700,000	-	-	200,000
5) Affordability of paying water charge by household	VND/hh/M	30,000	-	-	20,000
I. Financial condition of commune					
1) year					in 2000
2) Income	VND/year	-	-	-	450,000,000
3) Outlet	VND/year	-	-	-	256,000,000
4) Balance	VND/year	-	-	-	194,000,000

hh: house hold
M: month
D: day

Result of Baseline Survey of Ninh Binh Province

	Commune Name	Dong Phong	Quang Son	Yen Thang
	Commune No.	No. 5	No. 6	No. 7
A. Province/District information	Unit			
1) Name of concerned Province	-	Ninh Binh		
2) Center of concerned Province	-	Ninh Binh Town		
3) Population of the Province	person	920,000		
4) No. of District in the province	-	8		
5) No. of communes in the province	-	136		
6) Name of the concerned district	-	Nho Quan	Tam Diep Town	Yen Mo
7) Population of the district	person	145,922	70,000	128,000
8) No. of communes in the district	-	27	7	18
B. General condition				
1) No. of villages	-	9	12	15
2) Population (pop.)	person	10,000	7,500	8,685
3) Area (total)	km2	7.36	37	11.56
4) Area (residential)	km2	0.49	-	0.55
5) Pop. density (total area)	pop./ha	14	2	8
6) Pop. density (residential area)	pop./ha	204	-	158
7) Pop. Increasing ratio	%	1.19	1.5	0.9
8) No. of households (total area)	hh	2,462	1,700	2,200
C. Natural condition				
1) Rainfall	mm	-	-	1,800
2) Elevation at commune PC	m	-	-	-
D. Social Condition				
1) Pop. of Ave. household	person/hh	4	4	4
2) Pop. ratio (adult/child)	%	75%/25%	70/30	70/30
3) Pop. ratio (male/female)	%	48.2%/51.8%	49.2/50.8	46/54
4) Ratio of disease	%	75	80	9
5) Infant mortality rate(U14MR)	%	15	30	25
6) Under 5 mortality rate (U5MR)	%	6	10	10
7) Main product	-	Rice. peanut	Tea leaves	100% rice
8) Income of household	VND/hh/M	174,000	320,000	200,000-250,000
9) Medical payment	VND/hh/M	20,000	40,000	30,000
10) Electricity charge	VND/hh/M	20,000	15,000	20,000
11) School attendance rate (Primary school)	%	100%	99%	100%
12) School attendance rate (Secondary school)	%	100%	99%	100%
13) School attendance rate (High school)	%	30%	99%	30%
14) School attendance rate (Over high school)	%	29%	1%	5%
E. Accessibility				
1) Distance between capital of province and the commune	km	30	24	15
2) Access way	-	good	good	good
3) Traveling time	minutes	40	30	15
F. Existing infrastructure				
1) Road length	km	13.5	37	25
2) Ratio of pavement	%	100%	40%	72%
3) Covered ratio of electricity service	%	98%	90%	100%
4) Condition of solid waste management	-	Collected. no treatment is done	-	-
G. Existing condition on water supply				
1) Existence of water facilities in household	-	dug well (Ave. 2.5m depth)	Pond. dug well. rain water	dug well . rain water. river water.
2) Ratio of water sources (private dug well. private tub well. public well. others)	-	70% use dug well. 30% use river	60 - 30 - 10	-
3) Distance between house and water source	m	300-500	500	100-500
4) Water consumption rate	L/hh/d	280	320	320
5) Condition in rainy season	-	30% has no water. pollution water	100% has water	100% has water
6) Condition in dry season	-	-	water shortage	30% has no water
H. Consciousness on new water supply				
1) Request of service level (house connection/public stand pipe)	-	House connection	House connection	House connection
2) No. of household to be covered by the water supply project	%	95	100	100
3) Willingness to connect by household	%	100	100	100
4) Affordability of paying house connection fee by household	VND/hh	200,000	100,000-300,000	300,000-500,000
5) Affordability of paying water charge by household	VND/hh/M	15,000	15,000	15,000
I. Financial condition of commune				
1) year		in 2001's estimation	in 2000	in 2000
2) Income	VND/year	413,350,000	382,133,070	639,475,000
3) Outlet	VND/year	415,700,000	378,637,687	581,244,900
4) Balance	VND/year	-2,350,000	3,495,383	58,230,100

hh: house hold
M: month
D: day

Result of Baseline Survey of Thanh Hoa Province

	Commune Name	Vinh Thanh	Vinh Loc	Dinh Tuong	Thieu Hung	Thieu Do	Van Thang
	Commune No.	No.8	No. 9	No. 10	11	No. 12	No. 13
A. Province/District information	Unit						
1) Name of concerned Province	-	Thanh Hoa					
2) Center of concerned Province	-	Thanh Hoa City					
3) Population of the Province	person	3,446,541					
4) No. of District in the province	-	27					
5) No. of communes in the province	-	630					
6) Name of the concerned district	-	Vinh Loc	Vinh Loc	Yen Dinh	Thieu Hoa	Thieu Hoa	Nong Cong
7) Population of the district	person	84,949	84,949	17,000	195,479	195,479	185,000
8) No. of communes in the district	-	16	16	29	31	31	32
B. General condition							
1) No. of villages	-	8	3	5	11	11	11
2) Population (pop.)	person	6,000	5,900	6,628	6,785	7,463	6,536
3) Area (total)	km2	4.379	0.824	6.14	5.45	4.12	9.10
4) Area (residential)	km2	2.285	0.740	0.384	0.51	0.454	0.267
5) Pop. density (total area)	pop./ha	14	72	11	12	18	7
6) Pop. density (residential area)	pop./ha	26	80	173	133	164	245
7) Pop. Increasing ratio	%	0.5	1	0.8	0.63	0.7	0.6
8) No. of households (total area)	hh	-	-	1,470	1,780	1,575	1,570
C. Natural condition							
1) Rainfall	mm	-	-	-	1,600-1,900	1,600-1,950	-
2) Elevation at commune PC	m	10	-	-			-
D. Social Condition							
1) Pop. of Ave. household	person/hh	4	4	4.5	4	4	4.16
2) Pop. ratio (adult/child)	%	-	80/20	-	67.5/32.5	66.6/33.4	53.3/36.7
3) Pop. ratio (male/female)	%	49/51	45/55	47.7/52.3	45/55	52.56/47.44	48.3/51.7
4) Ratio of disease	%	20	10	40	6	5	63
5) Infant mortality rate(U14MR)	%	50	10	-	3.5	2.5	2.1
6) Under 5 mortality rate (U5MR)	%	-	1	-	1.5	1	1.6
7) Main product	-	Agriculture	Agriculture/service	100% Agriculture	100% Agriculture	70% rice. 30% silk worm	Rice
8) Income of household	VND/hh/M	150,000-180,000	600,000	-	1,250,000	300,000	470,000
9) Medical payment	VND/hh/M	25,000-30,000	55,000	25,000-30,000	6,000	20,000	20,000
10) Electricity charge	VND/hh/M	15,000	50,000	35,000	28,000	30,000	12,000
11) School attendance rate (Primary school)	%	100	100	-	100	100	99.1
12) School attendance rate (Secondary school)	%	100	100	-	100	100	97
13) School attendance rate (High school)	%	100	100	-	95	95	65
14) School attendance rate (Over high school)	%	20	5	-	2	5	5
E. Accessibility							
1) Distance between capital of province and the commune	km	45	45	30	15	15	33
2) Access way	-	Good	Good	Good	Ave.	Good	Good
3) Traveling time	minutes	90	90	45	30	30	1
F. Existing infrastructure							
1) Road length	km	4.2	4.5	35	22.6	16	7.5
2) Ratio of pavement	%	0	50	5	15	30	0
3) Covered ratio of electricity service	%	95	100	100	100	100	100
4) Condition of solid waste management	-	-	-	NA	collected	collected	Self-managed by hh
G. Existing condition on water supply							
1) Existence of water facilities in household	-	Dug well & drilled well	Dug well & drilled well	Dug well & drilled well	Dug well & drilled well	Dug well & drilled well	Dug well & drilled well
2) Ratio of water sources (private dug well. private tub well. public well. others)	-	87%	80%	16.4 % drilled well	83%	80 % drilled well	60/40
3) Distance between house and water source	m	-	-	40	20	20	10
4) Water consumption rate	L/hh/d	1,000	200	460	300	300	500
5) Condition in rainy season	-	bad	good	No problem	dirty	dirty	Enough quantity
6) Condition in dry season	-	30% has water shortage	1-2 months water shortage	water shortage	dry up. smell. color	dirty. color. smell	70% dug well dry up
H. Consciousness on new water supply							
1) Request of service level (house connection/public stand pipe)	-	House connection	100% House connection	100% House connection	100% House connection	100% House connection	House connection
2) No. of household to be covered by the water supply project	%	100	100	100	100	100	100
3) Willingness to connect by household	%	100	100	100	100	100	100
4) Affordability of paying house connection fee by household	VND/hh	300,000-700,000	300,000-700,000	300,000-500,000	300,000-1,000,000	200,000-300,000	500,000-700,000
5) Affordability of paying water charge by household	VND/hh/M	-	10,000 - 15,000	30,000-35,000	10,000-30,000	20,000	30,000
I. Financial condition of commune							
1) year		in 2000	in 2000	in 2000	in 2000	in 2000	in 2000
2) Income	VND/year	300,000,000	329,771,000	962,847,191	559,000,000	573,705,921	939,497,110
3) Outlet	VND/year	290,000,000	321,056,000	896,462,482	552,000,000	543,837,400	931,464,720
4) Balance	VND/year	10,000,000	8,715,000	66,384,709	7,000,000	29,868,521	8,032,390

hh: house hold
M: month
D: day

[Appendix – 7] Result of Socio-Economic Survey

Result of Socio-Economic Survey of Thai Nguyen Province

Province		Thai Nguyen				
District		Dong Hy		Thai Nguyen Town	Pho Yen	Average
No. of Commune		1	2	3	4	
Commune		Hoa Thuong	Dong Bam	Thinh Duc	Nam Tien	
Water source in rainy season	-	Pri Dug (80%) Nei Dug(10%) Rain(10%)	Pri Dug(100%)	Pri Dug(70%) Nei Dug(30%) River(60%)for wash	Pri Dug(90%) Pri Dril(10%)	
Duration of water shortage	Month	6	2	6	6	5
Affected population ratio by water shortage	%	80	20	65	30	49
Water source in dry season		Spring(80%) Same to rainy season(20%)	Pri Dug(80%) Nei Dug(20%) River(30%)	Pri Dug(35%) Nei Dug(65%) River(60%)for wash	Pri Dug(60%) Pri Dril(10%) Nei well(30%)	
Water quality	-	Dirty, smell	Dirty	Contaminated by grave, oil, solid waste, wastewater and DDT	Dirty	Dirty, smell
Affected duration by water quality	Month(m)	12	6 (Rainy season)	12	6 (Rainy season)	9
Affected population ratio by water shortage	%	100	100	80	70	88
Major deasease	-	Eye, skin, lever, kideny	Eye, skin, stomack	Eye, skin, stomack	Eye, skin	
Medical fee	VND/m/hh	10,000	10,000	20,000	30,000	17,500
Required service lecel	-	House connection	House connection	House connection	House connection	House connection
Affordable payment on house connection (A)	VND	300,000	300,000	400,000	400,000	350,000
A(VND) /income(VND/月/家)	-	60%	30%	114%	73%	58%
Affordable payment of water charge（B)	VND/m/hh	25,000	20,000	25,000	20,000	22,500
Water charge(C) / Income	-	5%	2%	7%	4%	4%
Water charge(C) / Electric charge	-	83%	67%	125%	100%	90%
Total of public charge (water and electric charge)		55,000	50,000	45,000	40,000	47,500
Public charge / Income		11%	5%	13%	7%	8%
Reference						
Income	VND/m/hh	500,000	1,000,000	350,000	550,000	600,000
Electric charge	VND/m/hh	30,000	30,000	20,000	20,000	25,000
Index						
Satisfactory in present water quantity	*1)	B	B	B	B	B
Satisfactory in present water quality	*2)	A	B	A	B	B
Requirement of the new water supply system	*3)	A	A	A	A	A
Affordable payment on house connection	*4)	B	B	B	B	B
Affordable payment on water charge	*5)	B	B	B	B	B
Appropriate of the project implementation	*6)	A	A	A	A	A

Remark: m: month, hh: household, Pri: private, Nei: neighbour,

Index	**Water quntity *1)**	**Water quality *2)**
A:	ortage every time	Not good every season
B:	rtage in dry season	Not good in some season
C:	Enough	Good

Index	**Requirement of the project *3)**
A:	All residents request urgent implementation
B:	Some residents request the implementation
C:	No requirement by residents

Index	**Affordable houe connection fee *4)**	**Affordable water charge *5)**
A:	Over 0.5 M VND （covering all expenses）	Over 30 T VND/m
B:	0.3～0.5 M VND（covering a part of expenses）	15～30 VND/m
C:	Less than 0.3 M VND（cover small part）	Less than 15 VND/m

Result of Socio-Economic Survey of Ninh Binh Province

Province		Ninh Binh			
District		Nho Quan	Tam Diep Town	Yen Mo	Average
No. of Commune		5	6	7	
Commune		Dong Phong	Quang Son	Yen Thang	
Water source in rainy season	-	Pri Dug(100%)	Dug well(60%) Rain(40%) Pond(80%) for wash	Pri Dug(20%) Pub Dug(80%) Rain(25%)	
Duration of water shortage	Month	5	4	6	5
Affected population ratio by water shortage	%	30	50	80	53
Water source in dry season		Pri Dug(70%) Nei Well(30%)	Dug well(60%) Rain(30%) buy(10%) Pond(100%) wash	Waterway(80%) same to rainy S.(20%)	
Water quality	-	Dirty	Dirty, lime	Solt, iron	Dirty, lime, salt, iron
Affected duration by water quality	Month(m)	6 (Rainy season)	12	12	10
Affected population ratio by water shortage	%	100	100	100	100
Major deasease	-	Eye, skin	Eye, skin	Eye, skin, women	Eye, skin, women
Medical fee	VND/m/hh	15,000	10,000	30,000	18,333
Required service lecel	-	House connection	House connection	House connection	House connection
Affordable payment on house connection (A)	VND	300,000	350,000	400,000	350,000
A(VND) /income(VND/月/家)	-	60%	100%	133%	91%
Affordable payment of water charge (B)	VND/m/hh	15,000	20,000	15,000	16,667
Water charge(C) / Income	-	3%	6%	5%	4%
Water charge(C) / Electric charge	-	75%	133%	100%	100%
Total of public charge (water and electric charge)		35,000	35,000	30,000	33,333
Public charge / Income		7%	10%	10%	9%
Reference					
Income	VND/m/hh	500,000	350,000	300,000	383,333
Electric charge	VND/m/hh	20,000	15,000	15,000	16,667
Index					
Satisfactory in present water quantity	*1)	B	B	B	B
Satisfactory in present water quality	*2)	B	A	A	B
Requirement of the new water supply system	*3)	A	A	A	A
Affordable payment on house connection	*4)	B	B	B	B
Affordable payment on water charge	*5)	B	B	B	B
Appropriate of the project implementation	*6)	A	A	A	A

Remark: m: month, hh: household, Pri: private, Nei: neighbour,

Index	**Water quntity *1)**	**Water quality *2)**
A:	ortage every time	Not good every season
B:	rtage in dry season	Not good in some season
C:	Enough	Good

Index	**Requirement of the project *3)**
A:	All residents request urgent implementation
B:	Some residents request the implementation
C:	No requirement by residents

Index	**Affordable houe connection fee *4)**	**Affordable water charge *5)**
A:	Over 0.5 M VND （covering all expenses）	Over 30 T VND/m
B:	0.3～0.5 M VND（covering a part of expenses）	15～30 VND/m
C:	Less than 0.3 M VND（cover small part）	Less than 15 VND/m

Index	**Appropriate of the implementation *6)**
A:	Appropriate
B:	Fair
C:	Inappropriate

Result of Socio-Economic Survey of Thanh Hoa Province

Province		Thanh Hoa						
District		Vin Loc		Yen Dinh	Thieu Hoa		Nong Cong	Average
No. of Commune		8	9	10	11	12	13	
Commune		Vinh Thanh	Vinh Loc Town	Dinh Tuong	Van Ha Town (Thieu Hung)	Thieu Do	Van Thang	
Water source in rainy season	-	Pri Dug(80%) Pri Dril(25%) River(10%) Rain(5%)	Same to left	Pri Dug(90%) Pri Dril(10%)	Pri Dug(60%) Pri Dril(40%) River/others(5%)	Pri Dug(25%) Pri Dril(75%) River/others(5%)	Pri Dug(60%) Pri Dril(40%)	
Duration of water shortage	Month	3	Ditto	2	3	3	3	3
Affected population ratio by water shortage	%	20	Ditto	0, saving water with the same source	50	25	40	34
Water source in dry season		Pri Dug(60%) Pri Dril(45%) Nei well,river(20%)	Ditto	Same to the rainy season	Pri Dug(10%) Pri Dril(40%) Nei well （50%)	Nei dril/river(25%) Pri Dril(75%)	Pri Dug(20%) Pri Dril(40%) Nei well(40%)	
Water quality	-	Dirty, lime, salt, iron	Ditto	Iron	Iron	Iron	Dirty, iron	Dirty, lime, salt, iron
Affected duration by water quality	Month(m)	12	Ditto	12	12	12	12	12
Affected population ratio by water shortage	%	100	Ditto	100	60	100	60	84
Major deasease	-	Eye, skin	Ditto	Eye, skin	Eye, skin, stomack	Eye, skin, stomack	Eye, skin, stomack	Eye, skin, stomack
Medical fee	VND/m/hh	15,000	Ditto	25,000	25,000	25,000	25,000	23,000
Required service lecel	-	House connection	Ditto	House connection	House connection	House connection	House connection	House connection
Affordable payment on house connection (A)	VND	400,000	Ditto	400,000	300,000	300,000	600,000	400,000
A(VND) /income(VND/月/家)	-	62%	Ditto	57%	38%	38%	75%	53%
Affordable payment of water charge （B)	VND/m/hh	20,000	Ditto	35,000	25,000	25,000	25,000	26,000
Water charge(C) / Income	-	3%	Ditto	5%	3%	3%	3%	4%
Water charge(C) / Electric charge	-	10%	Ditto	140%	83%	71%	125%	42%
Total of public charge (water and electric charge)		220,000	Ditto	60,000	55,000	60,000	45,000	88,000
Public charge / Income		34%	Ditto	9%	7%	8%	6%	12%
Reference			Ditto					
Income	VND/m/hh	650,000	Ditto	700,000	800,000	800,000	800,000	750,000
Electric charge	VND/m/hh	200,000	Ditto	25,000	30,000	35,000	20,000	62,000
Index			Ditto					
Satisfactory in present water quantity	*1)	B	Ditto	B	B	B	B	B
Satisfactory in present water quality	*2)	A	Ditto	A	A	A	A	A
Requirement of the new water supply system	*3)	A	Ditto	A	A	A	A	A
Affordable payment on house connection	*4)	B	Ditto	B	B	B	A	B
Affordable payment on water charge	*5)	B	Ditto	A	B	B	B	B
Appropriate of the project implementation	*6)	A	Ditto	A	A	A	A	A

Remark: m: month, hh: household, Pri: private, Nei: neighbour,

Index	**Water quntity *1)**	**Water quality *2)**
A:	ortage every time	Not good every season
B:	rtage in dry season	Not good in some season
C:	Enough	Good

Index	**Requirement of the project *3)**
A:	All residents request urgent implementation
B:	Some residents request the implementation
C:	No requirement by residents

Index	**Affordable houe connection fee *4)**	**Affordable water charge *5)**
A:	Over 0.5 M VND （covering all expenses）	Over 30 T VND/m
B:	0.3～0.5 M VND（covering a part of expenses）	15～30 VND/m
C:	Less than 0.3 M VND（cover small part）	Less than 15 VND/m

Index	**Appropriate of the implementation *6)**
A:	Appropriate
B:	Fair
C:	Inappropriate

[Appendix – 8] Water Quality Analysis

(1) General

Water quality analysis were carried out on 11 existing deep wells during June-November 2001. The sampled water was analyzed by two local laboratories in Hanoi; and additionally by a Japanese laboratory on major items.

(2) Outline of Water Quality Analysis Carried Out in the Study

2-1) Wells of Water Sampled

The existing deep wells in three Provinces (11 wells in total: 10 wells of JICA's test well and one well of private use)

JICA well (10 wells) : In communes Nos. 1, 3, 4, 5, 6, 8&9, 10, 11, 12 and 13

Private well (1 well) : In commune No.7

2-2) Number of Water Samples Analyzed

The above 11 deep well water was sampled and analyzed two times: the first (BD1) in June-July 2001, and the second (BD2) in October - November 2001.

2-3) Laboratory

The water was analyzed in three laboratories (two in Hanoi and one in Japan).

They are:

- Hanoi Health Service, the Center for Preventive Medicine
- Institute of Chemistry, National Center for Natural Science and Technology of Vietnam
- Laboratory of Docon Co., Ltd., Japan

2-4) Items Analyzed

Based on the "TCXD 233:1999 (The Criteria for Groundwater Quality Evaluation as Water Source, Vietnam)", 33 items of water quality were analyzed in two laboratories in Hanoi (A and B); and among the above, major items of iron, manganese, color and turbidity were also in Japan (C).

2-5) Evaluation

As to iron, manganese, color and turbidity, although they are important items for water treatment, the analyzed results of their concentration differed by laboratories.

The concentration of these items therefore were based on the results of the laboratory C.

(3) Water Quality Standards

Standards for water quality evaluation is based on the Vietnamese standards for drinking and domestic use of "Standard 505 of Ministry of Health (Drinking and Domestic Water Quality Standard), Vietnam".

(4) Water Treatment

4-1) Groundwater which meets the drinking water standards will be supplied after chlorination process; without particular treatment.

4-2) Unqualified Substances

- In the case groundwater contains iron and/or manganese more than the drinking water standards, they will be removed by treatment.
- Bacteria and coliform groups will be sterilized by chlorination.
- As to color and turbidity, they will be removed together with removal of iron /manganese, since they might have been caused by the existence of iron/manganese.
- Other substances could not be removed with conventional and normal treatment process. Therefore, groundwater containing such substances more than the drinking water standards will not be used as water source; and a water supply system for the commune will not be considered by the project.

(5) Lead Concentration

In two deep wells in Van Ha (Thieu Hung Commune: No.11) and Thieu Do (No.12), a heavy metal of lead (Pb) was once (BD1) detected in more than the permissible level by a local laboratory. However, the laboratory of C detected less concentration of lead (Pb) in the two deep wells. Hence, lead concentration of the two well water were judged to be within the permissible level.

(6) Ammonia Concentration

Among 11 deep wells, a well in Thieu Do Commune (No.12) was found to contain more ammonia (4.3 mg/l) than the permissible value (3.0 mg/l) in both BD1 and BD2 analyses. Hence, this well will not be used as water source and a water supply system will not be proposed in this commune by the project.

(7) Iron Concentration

Among 11 deep wells, two wells in Hoa Thoung (No.1) and Dinh Tuong (No.10) showed higher concentration of iron than the standard level (0.5 mg/l). Accordingly, the following communes will have iron removal process:

3 water supply systems in communes of No.1 : Hoa Thuong, No.2 : Dong Bam and No.10 : Dinh Tuong

Note: No.2 Commune is to be added, since water quality of No.2 is considered to be same as that of No.1.

(8) Manganese Concentration

Among 11 deep wells, manganese was detected more than its permissible level (0.1 mg/l) in 6 wells in communes of Nos.1, 4, 8/9, 10, 11 and 13. Among the above, No.12 Commune is excluded from the project due to existence of high ammonia. Therefore, communes need to have facility of manganese removal will be the following:

6 water supply systems in communes of No.1 : Hoa Thuong, No.2 : Dong Bam, No.4 : Nam Tien, No.8&9 : Vinh Thanh and Vinh Loc, No.10 : Dinh Tuong and No.11 : Van Ha (Thieu Hung).

(9) Communes with Quality Groundwater

On the other hand, the following communes with good quality groundwater will not require particular treatment process are following:

5 water supply systems in communes of No.3 : Thinh Duc, No.5 : Dong Phong, No.6 : Quang Son, No.7 Yen Thang and No.13 Van Thang

(10) Nitrite Concentration

In some deep wells, Nitrite (NO_2^-) was found to little extent (Vietnamese standard = 0 mg/l) in communes of Nos. 1, 3, 5, 7, 11 and 13. However, Nitrite can be converted to the same concentration of Nitrate (NO_3^-) immediately after chlorination dosage. Nitrate concentration in the wells is comparatively low and its permissible level is large as 10 mg/l. Therefore, existence of Nitrite will not be problem issue.

(11) Summary of Treatment

Table 1 Summary of Treatment Facilities

Province	Commune	Water Quality	Treatment Facility Required	Construction of Water Supply System
Thai Nguyen	No.1: Hoa Thuong	Iron and Manganese	Removal of iron/manganese	Yes
	No.2: Dong Bam	- ditto -	- ditto -	Yes
	No.3: Thinh Duc	Good quality	Not required	Yes
	No.4: Nam Tien	Manganese	Removal of manganese	Yes
Ninh Binh	No.5: Dong Phong	Good quality	Not required	Yes
	No.6: Quang Son	Good quality	Not required	Yes
	No.7: Yen Thang	Good quality	Not required	Yes
Thanh Hoa	No.8 & 9: Vinh Thanh & Vinh Loc	Manganese	Removal of manganese	Yes
	No.10: Dinh Tuong	Iron and Manganese	Removal of iron/manganese	Yes
	No.11: Van Ha (Thieu Hung)	Manganese	Removal of manganese	Yes
	No.12: Thieu Do	Ammonia	-	No
	No.13: Van Thang	Good quality	Not required	Yes
Total			6 sites of treatment	11 Systems

Results of Water Quality Analysis (No.1 of 6)

				Commune	**No.1 Hoa Thuong**				**No.3 Thinh Duc**			
				Well No.	JICA-2				JICA-4			
				Water sampled by :	**BD1**	**BD2**			**BD1**	**BD2**		
				Analyzed by :	**A**	**A**	**B**	**C**	**A**	**A**	**B**	**C**
Item			Standards									
			Vietnam	WHO								
1	Colour (Cobalt scale)		10	-	None	None	<2	<1	None	None	<2	<1
2	Odour		None	-	None	None	None		None	None	None	
3	Taste		None	-	None	None	None		None	None	None	
4	PH		6.5-8.5	-	7.0	7.5	7.7		7.2	7.4	7.8	
5	Turbidity (Sneller)	cm	>25	-	**3.0**		**19.6**	25	>30		>90	>30
6	Total dissolved solids	mg/l	1,000	- (1,000)	57.5	58.5	245		382.25	388.0	104	
7	Total suspended solid	mg/l	-	-	20.65	377.4	276		250.0	227.6	119	
8	Nitrite (NO_{2-})	mg/l	0	0.91	0.0	0.01	**0.012**		0.01	**0.04**	**0.030**	
9	Nitrate (NO_{3-})	mg/l	10.0	11.3	2.5	1.0	5.65	1.5	1.5	0.5	1.62	0.19
10	Ammonia (NH_4^+)	mg/l	3.0	- (1.5)	0.1	0.1	<0.01		0.0	0.1	<0.01	
11	Phosphate (PO_4^{-3})	mg/l	(2.5)	-	0.8	1.0	0.21		1.2	1.54	0.07	
12	Organic compounds	mg/l	(4.0)	-	1.12	0.96	0.75		1.76	0.32	0.60	
13	Iron	mg/l	0.5	- (0.3)	0.12	**0.594**	**2.65**	**1.1**	0.02	0.01	0.14	0.09
14	NaCl	mg/l	250 or 500	- (250)	58.5	35.1	12.6		11.7	23.4	9.5	
15	Total hardness $CaCO_3$	mg/l	500	-	203.84	199.36	260		103.04	120.96	71.0	
16	Sulfide	mg/l	-	-	0.0069	0.0052	0.01		0.0013	0.0033	0.01	
17	Sulphate	mg/l	400	- (250)			19.71				6.50	
18	Manganese	mg/l	0.1	0.5 (0.1)	0.0943	0.0333	**0.20**	**0.15**	0.0168	0.0214	**0.18**	0.10
19	Flouride	mg/l	1.5	1.5	0.0097	0.0273	0.45		0.0086	0.0184	0.10	
20	Cyanide	mg/l	0.1	0.07	0.0073	0.0085	0.004		0.0011	0.0038	0.004	
21	Phenol	mg/l	-	-	0.0011	0.00091	0.001		<0.0005	0.00047	0.001	
22	Arsenic	mg/l	0.05	0.01	0.0095	0.0086	<0.001		0.0022	0.0054	0.007	
23	Cadmium	mg/l	0.005	0.003	0.0035	0.0032	0.0002		0.0011	0.0035	0.0003	
24	Chromium	mg/l	0.05	0.05	0.0061	0.0073	<0.001		0.0027	0.0061	0.0030	
25	Selenium	mg/l	0.01	0.01	0.0074	0.0042	0.0040		0.0013	0.0047	<0.001	
26	Mercury	mg/l	0.001	0.001	0.00093	0.00045	0.0001		0.00041	0.00038	0.0002	
27	Copper	mg/l	1.0	2	0.0548	0.0313	0.0025		0.0065	0.0064	0.0021	
28	Lead	mg/l	0.05	0.01	0.0125	0.0113	0.0052		0.0053	0.0079	0.0015	
29	Zinc	mg/l	5.0	- (3)	0.8879	0.1964	0.0442		0.0474	0.0847	0.0029	
30	Silica	mg/l	-	-			2.90				11.14	
31	Coliform	100ml	0	0	**200**	**200**	**186**		**240**	**2**	0	
32	Faecal coliform	100ml	0	0	0	0	**10**		**240**	0	0	
33	Clostridium perfringens	10ml	(0)	-	**2**	0	**4**		0	0	**8**	

Note:

- Standards : Vietnamese water standards for drinking and domestic use (in rural area with groundwater source)
- WHO : Guidelines for drinking-water quality
- Water sampled by :
  "**BD1**" : JICA Basic Design Team during June-August 2001
  "**BD2**" : JICA Basic Design Team during October-November 2001
- Analyzed by the Laboratory of :
  "**A**" : Hanoi Health Service, the Center for Preventive Medicine
  "**B**" : Institute of Chemistry, National Center for Natural Sciences and Technology of Vietnam
  "**C**" : Docon Co., Ltd, Japan

Results of Water Quality Analysis (No.2 of 6)

				Commune	**No.4 Nam Tien**				**No.5 Dong Phong**			
				Well No.	JICA-3				JICA-7			
				Water sampled by :	**BD1**	**BD2**			**BD1**	**BD2**		
				Analyzed by :	**A**	**A**	**B**	**C**	**A**	**A**	**B**	**C**
Item			Standards									
			Vietnam	WHO								
1	Colour (Cobalt scale)		10	-	None	None	<2	<1	None	None	<2	<1
2	Odour		None	-	None	None	None		None	None	None	
3	Taste		None	-	None	None	None		None	None	None	
4	PH		6.5-8.5	-	6.6	7.1	6.6		7.4	7.2	7.5	
5	Turbidity (Sneller)	cm	>25	-	**7.0**		**21.5**	30	>30		>90	>30
6	Total dissolved solids	mg/l	1,000	- (1,000)	350.0	227.7	69.0		365.0	354.5	185	
7	Total suspended solid	mg/l	-	-	325.0	413.0	83.0		415.0	410.0	187	
8	Nitrite (NO_{2-})	mg/l	0	0.91	0.0	**0.01**	<0.01		**0.01**	0.0	**0.03**	
9	Nitrate (NO_{3-})	mg/l	10.0	11.3	0.5	0.0	0.12	<0.02	1.4	0.1	0.77	0.26
10	Ammonia (NH_4^+)	mg/l	3.0	- (1.5)	0.0	0.0	<0.01		0.5	0.0	0.01	
11	Phosphate (PO_4^{-3})	mg/l	(2.5)	-	1.5	1.5	1.47		1.3	1.34	0.40	
12	Organic compounds	mg/l	(4.0)	-	1.28	0.48	0.90		2.4	1.28	0.78	
13	Iron	mg/l	0.5	- (0.3)	0.09	0.08	**0.93**	0.38	0.01	0.0	0.16	0.38
14	NaCl	mg/l	250 or 500	- (250)	23.4	11.7	19.6		40.9	46.8	26.2	
15	Total hardness $CaCO_3$	mg/l	500	-	69.44	127.68	55.0		226.24	203.84	185	
16	Sulfide	mg/l	-	-	0.0015	0.0048	0.015		0.0011	0.0035	0.02	
17	Sulphate	mg/l	400	- (250)			<1.0				11.7	
18	Manganese	mg/l	0.1	0.5 (0.1)	0.0219	0.0732	0.085	**0.16**	0.0475	0.0354	0.06	0.04
19	Flouride	mg/l	1.5	1.5	0.0074	0.0441	0.19		0.0064	0.0108	0.04	
20	Cyanide	mg/l	0.1	0.07	0.001	0.0079	0.004		0.0015	0.0021	0.003	
21	Phenol	mg/l	-	-	<0.0005	0.00033	<0.001		<0.0005	<0.0001	<0.001	
22	Arsenic	mg/l	0.05	0.01	0.0041	0.0071	0.003		0.0045	0.0035	0.001	
23	Cadmium	mg/l	0.005	0.003	0.0013	0.0035	0.0001		0.0023	0.0015	<0.0001	
24	Chromium	mg/l	0.05	0.05	0.0019	0.0082	<0.001		0.0028	0.0041	0.0012	
25	Selenium	mg/l	0.01	0.01	0.0026	0.0053	0.0040		0.0032	0.002	<0.001	
26	Mercury	mg/l	0.001	0.001	0.00054	0.00041	0.0002		0.00056	0.00041	0.0002	
27	Copper	mg/l	1.0	2	0.0115	0.0217	0.0002		0.0067	0.0119	0.0027	
28	Lead	mg/l	0.05	0.01	0.0042	0.0111	0.0110		0.0071	0.0085	0.0015	
29	Zinc	mg/l	5.0	- (3)	0.0216	0.1087	0.0302		0.0533	0.0281	0.0032	
30	Silica	mg/l	-	-			2.15				1.68	
31	Coliform	100ml	0	0	**>240**	**200**	0		**>240**	**200**	0	
32	Faecal coliform	100ml	0	0	0	**200**	0		**240**	**200**	0	
33	Clostridium perfringens	10ml	(0)	-	0	0	0		**1**	**2**	**5**	

Note:

- Standards : Vietnamese water standards for drinking and domestic use (in rural area with groundwater source)
- WHO : Guidelines for drinking-water quality
- Water sampled by :
  "**BD1**" : JICA Basic Design Team during June-August 2001
  "**BD2**" : JICA Basic Design Team during October-November 2001
- Analyzed by the Laboratory of :
  "**A**" : Hanoi Health Service, the Center for Preventive Medicine
  "**B**" : Institute of Chemistry, National Center for Natural Sciences and Technology of Vietnam
  "**C**" : Docon Co., Ltd, Japan

Results of Water Quality Analysis (No.3 of 6)

				Commune	**No.6 Quang Son**				**No.7 Yen Thang**			
				Well No.	JICA-5				Private well			
				Water sampled by :	**BD1**	**BD2**			**BD1**	**BD2**		
				Analyzed by :	**A**	**A**	**B**	**C**	**A**	**A**	**B**	**C**
Item			Standards									
			Vietnam	WHO								
1	Colour (Cobalt scale)		10	-	None	None	<2	<1	None	None	<2	<1
2	Odour		None	-	None	None	None		None	None	None	
3	Taste		None	-	None	None	None		None	None	None	
4	PH		6.5-8.5	-	7.1	7.4	7.3		7.6	7.3	7.15	
5	Turbidity (Sneller)	cm	>25	-	**11.0**		39.8	>30	30.0		>90	>30
6	Total dissolved solids	mg/l	1,000	- (1,000)	111.5	120.5	160		288.5	291.0	160	
7	Total suspended solid	mg/l	-	-	233.0	250.0	172		189.0	191.0	165	
8	Nitrite (NO_{2-})	mg/l	0	0.91	0.0	0.0	**0.03**		**0.01**	0.0	**0.01**	
9	Nitrate (NO_{3-})	mg/l	10.0	11.3	2.5	2.0	**11.62**	2.9	3.0	1.5	6.27	1.7
10	Ammonia (NH_4^+)	mg/l	3.0	- (1.5)	0.5	0.0	0.01		0.0	0.0	0.01	
11	Phosphate (PO_4^{-3})	mg/l	(2.5)	-	2.0	1.5	0.45		2.4	1.7	0.46	
12	Organic compounds	mg/l	(4.0)	-	1.28	0.8	0.75		1.12	0.64	0.72	
13	Iron	mg/l	0.5	- (0.3)	0.01	0.01	**0.85**	0.50	0.2	0.0	0.14	0.10
14	NaCl	mg/l	250 or 500	- (250)	29.2	35.1	7.9		35.1	40.9	19.5	
15	Total hardness $CaCO_3$	mg/l	500	-	174.72	210.56	185		206.8	194.88	170.0	
16	Sulfide	mg/l	-	-	0.0053	0.0047	0.01		0.0019	0.0032	0.03	
17	Sulphate	mg/l	400	- (250)			1.15				1.28	
18	Manganese	mg/l	0.1	0.5 (0.1)	0.0483	0.0053	0.05	0.02	0.0236	0.00317	0.02	<0.01
19	Flouride	mg/l	1.5	1.5	0.0092	0.00314	0.06		0.0061	0.0043	0.12	
20	Cyanide	mg/l	0.1	0.07	0.0035	0.0041	0.003		0.0021	0.0025	0.003	
21	Phenol	mg/l	-	-	0.0012	0.00061	<0.001		<0.001	<0.0001	<0.001	
22	Arsenic	mg/l	0.05	0.01	0.0081	0.0072	<0.001		0.0053	0.0049	<0.001	
23	Cadmium	mg/l	0.005	0.003	0.0041	0.0021	0.0004		0.0026	0.0018	0.0002	
24	Chromium	mg/l	0.05	0.05	0.0069	0.0093	0.0015		0.0045	0.0048	<0.001	
25	Selenium	mg/l	0.01	0.01	0.0069	0.0043	<0.001		0.0040	0.0029	0.0015	
26	Mercury	mg/l	0.001	0.001	0.00093	0.00071	0.0003		0.00075	0.00035	0.0004	
27	Copper	mg/l	1.0	2	0.0185	0.0286	0.0048		0.0117	0.0174	0.0056	
28	Lead	mg/l	0.05	0.01	0.0113	0.0015	0.0019		0.0086	0.0091	0.0073	
29	Zinc	mg/l	5.0	- (3)	0.0541	0.1845	0.0023		0.0315	0.0316	0.0240	
30	Silica	mg/l	-	-			1.869				1.682	
31	Coliform	100ml	0	0	**96**	**38**	0		**96**	**38**	0	
32	Faecal coliform	100ml	0	0	**96**	**38**	0		**96**	**38**	0	
33	Clostridium perfringens	10ml	(0)	-	**1**	0	0		0	0	0	

Note:

- Standards : Vietnamese water standards for drinking and domestic use (in rural area with groundwater source)
- WHO : Guidelines for drinking-water quality
- Water sampled by :
  "**BD1**" : JICA Basic Design Team during June-August 2001
  "**BD2**" : JICA Basic Design Team during October-November 2001
- Analyzed by the Laboratory of :
  "**A**" : Hanoi Health Service, the Center for Preventive Medicine
  "**B**" : Institute of Chemistry, National Center for Natural Sciences and Technology of Vietnam
  "**C**" : Docon Co., Ltd, Japan

Results of Water Quality Analysis (No.4 of 6)

				Commune	**No.8 Vinh Thanh**				**No.10 Dinh Tuong**			
				Well No.	JICA-11				JICA-10			
				Water sampled by :	**BD1**	**BD2**			**BD1**	**BD2**		
				Analyzed by :	**A**	**A**	**B**	**C**	**A**	**A**	**B**	**C**
Item			Standards									
			Vietnam	WHO								
1	Colour (Cobalt scale)		10	-	None	None	<2	<1	**Yellow**	**Yellow**	<2	2
2	Odour		None	-	None	None	None		None	None	None	
3	Taste		None	-	None	None	None		None	None	None	
4	PH		6.5-8.5	-	7.3	7.8	7.09		7.0	7.4	7.2	
5	Turbidity (Sneller)	cm	>25	-	**7.0**		61.8	>30	**6.9**		**12.0**	>30
6	Total dissolved solids	mg/l	1,000	- (1,000)	100.0	139.6	233		430.0	404.2	175	
7	Total suspended solid	mg/l	-	-	228.5	170.4	245		500.0	502.0	203	
8	Nitrite (NO_{2-})	mg/l	0	0.91	0.0	0.0	<0.01		0.0	0.0	**0.01**	
9	Nitrate (NO_{3-})	mg/l	10.0	11.3	0.0	3.5	0.186	0.56	1.0	1.5	0.186	0.02
10	Ammonia (NH_4^+)	mg/l	3.0	- (1.5)	0.0	1.0	0.01		3.0	**4.0**	2.50	2.8
11	Phosphate (PO_4^{-3})	mg/l	(2.5)	-	1.8	2.5	1.38		1.5	**2.65**	1.2	
12	Organic compounds	mg/l	(4.0)	-	0.64	1.28	0.75		1.6	1.92	1.35	
13	Iron	mg/l	0.5	- (0.3)	0.04	0.012	0.46	0.20	**1.02**	**2.05**	**4.40**	**2.7**
14	NaCl	mg/l	250 or 500	- (250)	29.2	23.4	19.0		35.1	40.9	28.5	
15	Total hardness $CaCO_3$	mg/l	500	-	248.64	286.72	235		170.24	154.56	140.0	
16	Sulfide	mg/l	-	-	0.0025	0.0041	0.04		0.0064	0.0084	0.01	
17	Sulphate	mg/l	400	- (250)			2.45				<1.0	
18	Manganese	mg/l	0.1	0.5 (0.1)	0.0317	0.0486	**0.29**	**0.25**	**0.1106**	0.0922	**0.35**	**0.34**
19	Flouride	mg/l	1.5	1.5	0.0043	0.0051	0.06		0.0121	0.0095	0.17	
20	Cyanide	mg/l	0.1	0.07	0.0031	0.0033	0.003		0.0062	0.0062	0.003	
21	Phenol	mg/l	-	-	0.0063	0.00087	<0.001		0.0011	0.00098	<0.001	
22	Arsenic	mg/l	0.05	0.01	0.0034	0.0041	<0.001		0.0113	0.0089	0.032	
23	Cadmium	mg/l	0.005	0.003	0.0033	0.0032	0.003		0.0047	0.0037	0.0001	
24	Chromium	mg/l	0.05	0.05	0.0032	0.0073	<0.001		0.0039	0.0091	0.0030	
25	Selenium	mg/l	0.01	0.01	0.0056	0.0064	0.0040		0.0071	0.0059	<0.001	
26	Mercury	mg/l	0.001	0.001	0.00091	0.00068	0.0002		0.00091	0.00071	0.0004	
27	Copper	mg/l	1.0	2	0.0115	0.0281	0.0076		0.0175	0.0613	0.0013	
28	Lead	mg/l	0.05	0.01	0.0096	0.0079	0.0088		0.0217	0.0115	0.0056	
29	Zinc	mg/l	5.0	- (3)	0.0265	0.0672	0.0198		0.1483	0.0941	0.0022	
30	Silica	mg/l	-	-			12.15				25.23	
31	Coliform	100ml	0	0	**38**	**9**	0		0	**200**	**56**	
32	Faecal coliform	100ml	0	0	0	**9**	0		0	**200**	**8**	
33	Clostridium perfringens	10ml	(0)	-	0	0	0		0	0	**5**	

Note:

- Standards : Vietnamese water standards for drinking and domestic use (in rural area with groundwater source)
- WHO : Guidelines for drinking-water quality
- Water sampled by :
  "**BD1**" : JICA Basic Design Team during June-August 2001
  "**BD2**" : JICA Basic Design Team during October-November 2001
- Analyzed by the Laboratory of :
  "**A**" : Hanoi Health Service, the Center for Preventive Medicine
  "**B**" : Institute of Chemistry, National Center for Natural Sciences and Technology of Vietnam
  "**C**" : Docon Co., Ltd, Japan

Results of Water Quality Analysis (No.5 of 6)

				Commune	**No.11 Van Ha** (Thieu Hung)				**No.12 Thieu Do**			
				Well No.	JICA-9				JICA-14			
				Water sampled by :	**BD1**	**BD2**			**BD1**	**BD2**		
				Analyzed by :	**A**	**A**	**B**	**C**	**A**	**A**	**B**	**C**
Item			Standards									
			Vietnam	WHO								
1	Colour (Cobalt scale)		10	-	None	None	4.0	1	None	None	**12.0**	**12**
2	Odour		None	-	None	None	None		None	None	0	
3	Taste		None	-	None	None	None		None	None	None	
4	PH		6.5-8.5	-	7.2	**6.4**	7.6	7	7.0	7.0	8.0	
5	Turbidity (Sneller)	cm	>25	-	29.0	27.0	90	>30	**8.5**	**18.0**	90	>30
6	Total dissolved solids	mg/l	1,000	- (1,000)	306.0	275.0	259		348.5	400.5	380	
7	Total suspended solid	mg/l	-	-	295.0	307.0	277		362.5	483.5	407	
8	Nitrite (NO_{2-})	mg/l	0	0.91	0.0	**0.05**	**0.04**	**0.024**	0.0	**0.03**	**0.04**	**0.26**
9	Nitrate (NO_{3-})	mg/l	10.0	11.3	0.0	0.0	0.01		1.0	0.1	0.01	
10	Ammonia (NH_4^+)	mg/l	3.0	- (1.5)	2.0	2.0	2.0		**4.0**	**4.5**	**4.4**	
11	Phosphate (PO_4^{-3})	mg/l	(2.5)	-	2.4	1.0	1.05		**3.0**	2.0	**3.3**	
12	Organic compounds	mg/l	(4.0)	-	1.44	1.6	1.35		4.0	4.0	1.65	
13	Iron	mg/l	0.5	- (0.3)	0.01	0.16	**1.25**	0.13	0.38	**0.75**	**2.36**	0.37
14	NaCl	mg/l	250 or 500	- (250)	151.1	169.6	163.0		70.2	134.5	113.0	
15	Total hardness $CaCO_3$	mg/l	500	-	170.24	170.24	150.0		123.2	100.8	80.0	
16	Sulfide	mg/l	-	-	0.0024	0.0015	<0.01		0.0102	0.0041	<0.01	
17	Sulphate	mg/l	400	- (250)			1.41				18.01	
18	Manganese	mg/l	0.1	0.5 (0.1)	0.0377	0.0208	**1.6**	**1.6**	**0.1209**	0.0563	**0.20**	**0.15**
19	Flouride	mg/l	1.5	1.5	0.0075	0.0093	0.58		0.0084	0.0114	0.55	
20	Cyanide	mg/l	0.1	0.07	0.0026	0.0012	0.002		0.0053	0.0027	0.004	
21	Phenol	mg/l	-	-	0.001	0.00066	<0.001		0.001	0.00075	<0.001	
22	Arsenic	mg/l	0.05	0.01	0.0049	0.0028	0.004		0.0132	0.0043	0.0033	
23	Cadmium	mg/l	0.005	0.003	0.0028	0.0017	0.0005		0.0043	0.0019	0.0003	
24	Chromium	mg/l	0.05	0.05	0.0053	0.0025	<0.001		0.0085	0.0034	<0.001	
25	Selenium	mg/l	0.01	0.01	0.0045	0.0019	0.003		0.0071	0.0033	0.0035	
26	Mercury	mg/l	0.001	0.001	0.00068	0.00053	<0.001		0.0009	0.00081	<0.001	
27	Copper	mg/l	1.0	2	0.0109	0.0064	0.0093		0.0353	0.0095	0.0056	
28	Lead	mg/l	0.05	0.01	**(0.095)**	0.0063	0.0025	0.0034	**(0.125)**	0.0085	0.0029	<0.0005
29	Zinc	mg/l	5.0	- (3)	0.0334	0.0277	0.0053		0.0817	0.0068	0.0026	
30	Silica	mg/l	-	-			19.07				21.68	
31	Coliform	100ml	0	0	**5**	**240**	0		**96**	**240**	0	
32	Faecal coliform	100ml	0	0	0	0	0		0	**240**	0	
33	Clostridium perfringens	10ml	(0)	-	0	0	**3**		0	0	**1**	

Note:

- Standards : Vietnamese water standards for drinking and domestic use (in rural area with groundwater source)
- WHO : Guidelines for drinking-water quality
- Water sampled by :
  "**BD1**" : JICA Basic Design Team during June-August 2001
  "**BD2**" : JICA Basic Design Team during October-November 2001
- Analyzed by the Laboratory of :
  "**A**" : Hanoi Health Service, the Center for Preventive Medicine
  "**B**" : Institute of Chemistry, National Center for Natural Sciences and Technology of Vietnam
  "**C**" : Docon Co., Ltd, Japan

Results of Water Quality Analysis (No.6 of 6)

				Commune	**No.13 Van Thang**			
				Well No.	JICA-8			
				Water sampled by :	**BD1**	**BD2**		
				Analyzed by :	**A**	**A**	**B**	**C**
Item			Standards					
			Vietnam	WHO				
1	Colour (Cobalt scale)		10	-	None	None	<2	<1
2	Odour		None	-	None	None	None	
3	Taste		None	-	None	None	None	
4	PH		6.5-8.5	-	6.9	7.2	7.05	
5	Turbidity (Sneller)	cm	>25	-	25.5		>90	>30
6	Total dissolved salts	mg/l	1,000	- (1,000)	624.5	692.0	710.0	
7	Total suspended solid	mg/l	-	-	638.0	522.0	722.0	
8	Nitrite (NO_{2-})	mg/l	0	0.91	0.0	**0.02**	**0.01**	
9	Nitrate (NO_{3-})	mg/l	10.0	11.3	0.0	0.1	3.48	0.14
10	Ammonia (NH_4^+)	mg/l	3.0	- (1.5)	0.0	0.1	0.03	
11	Phosphate (PO_4^{-3})	mg/l	(2.5)	-	2.0	1.2	1.50	
12	Organic compounds	mg/l	(4.0)	-	1.28	1.6	1.50	
13	Iron	mg/l	0.5	- (0.3)	0.06	0.08	0.41	0.18
14	NaCl	mg/l	250 or 500	- (250)	456.3	**526.5**	235.0	
15	Total hardness $CaCO_3$	mg/l	500	-	253.12	264.32	285.0	
16	Sulfide	mg/l	-	-	0.0047	0.0022	<0.01	
17	Sulphate	mg/l	400	- (250)			12.52	
18	Manganese	mg/l	0.1	0.5 (0.1)	0.0317	0.0386	**0.230**	0.10
19	Flouride	mg/l	1.5	1.5	0.0080	0.0122	0.003	
20	Cyanide	mg/l	0.1	0.07	0.0021	0.0025	<0.001	
21	Phenol	mg/l	-	-	0.00086	0.00017	<0.001	
22	Arsenic	mg/l	0.05	0.01	0.0057	0.0035	0.002	
23	Cadmium	mg/l	0.005	0.003	0.0031	0.0021	0.0001	
24	Chromium	mg/l	0.05	0.05	0.0052	0.0051	0.0020	
25	Selenium	mg/l	0.01	0.01	0.0050	0.0028	<0.001	
26	Mercury	mg/l	0.001	0.001	0.0008	0.00049	0.0004	
27	Copper	mg/l	1.0	2	0.0118	0.0181	<0.0001	
28	Lead	mg/l	0.05	0.01	0.0091	0.0079	0.0026	
29	Zinc	mg/l	5.0	- (3)	0.0215	0.0864	0.890	
30	Silica	mg/l	-	-			11.68	
31	Coliform	100ml	0	0	**96**	**200**	**60**	
32	Faecal coliform	100ml	0	0	0	**200**	0	
33	Clostridium perfringens	10ml	(0)	-	0	0	**5**	

Note:

- Standards : Vietnamese water standards for drinking and domestic use (in rural area with groundwater source)
- WHO : Guidelines for drinking-water quality
- Water sampled by :
  "**BD1**" : JICA Basic Design Team during June-August 2001
  "**BD2**" : JICA Basic Design Team during October-November 2001
- Analyzed by the Laboratory of :
  "**A**" : Hanoi Health Service, the Center for Preventive Medicine
  "**B**" : Institute of Chemistry, National Center for Natural Sciences and Technology of Vietnam
  "**C**" : Docon Co., Ltd, Japan

[Appendix – 9] Pumping Test

Pumping tests were carried out at wells that have problems on water quality in the previous JICA Study (M/P and F/S) among the study area; simultaneously, water was sampled for analysis.

Well Nos. and commune names of the wells where the pumping tests were carried out are shown in Table 1. The well Nos. are referred to the previous JICA Study.

Table 1 Location of the Pumping Tests

Well No.	J-2	J-5	J-8	J-9	J-11	J-14
Commune	Hoa Thuong	Quang Son	Van Thang	Tieu Hung	Vinh Thanh	Tieu Do

Results of the pumping tests (step, continue and recover) are shown in Table 2 and Figs. 1 and 2.

Table 2 Result of Step Pumping Test

Well No.	Item		Step				S.W.L
			1	2	3	4	(m)
J-2	B/D	Q	706	1058	1411	1800	
		s	1.02	1.84	2.81	3.90	1.61
	M/P	Q	360	720	1080	1440	
		s	0.55	1.80	2.21	3.76	3.1
J-5	B/D	Q	95	190	282	380	
		s	5.20	9.47	17.98	31.93	9.8
	M/P	Q	86.4	173	259	346	
		s	8.00	15.20	21.90	43.00	10.8
J-8	B/D	Q	147	294	441	588	
		s	7.58	18.98	36.60	54.2	4.5
	F/S	Q	158	272	475	634	
		s	9.83	20.98	41.60	56.53	5.7
J-9	B/D	Q	706	1058	1411	1800	
		s	3.01	7.04	8.78	10.71	3.73
	M/P	Q	353	706	1058	1411	
		s	2.40	4.55	7.12	10.01	4
J-11	B/D	Q	706	1058	1411	1800	
		s	5.48	9.63	14.20	17.32	5.4
	M/P	Q	362	734	1123	1512	
		s	1.86	4.90	9.80	14.27	7.55
J-14	B/D	Q	449	900	1350	1800	
		s	1.97	4.03	6.90	11.5	2.55
	M/P	Q	475	950	1426	1901	
		s	2.08	4.21	7.01	13.67	2.85

Note:
- B/D: Basic Design study stage (June-July 2001
- M/P: Master Plan study stage (1999)
- Q: Well Discharge (m3/day)
- s: Drawdown (m)
- S.W.L: static water level

It is concluded that the proposed water production by the previous JICA Study is reasonable based on the pumping

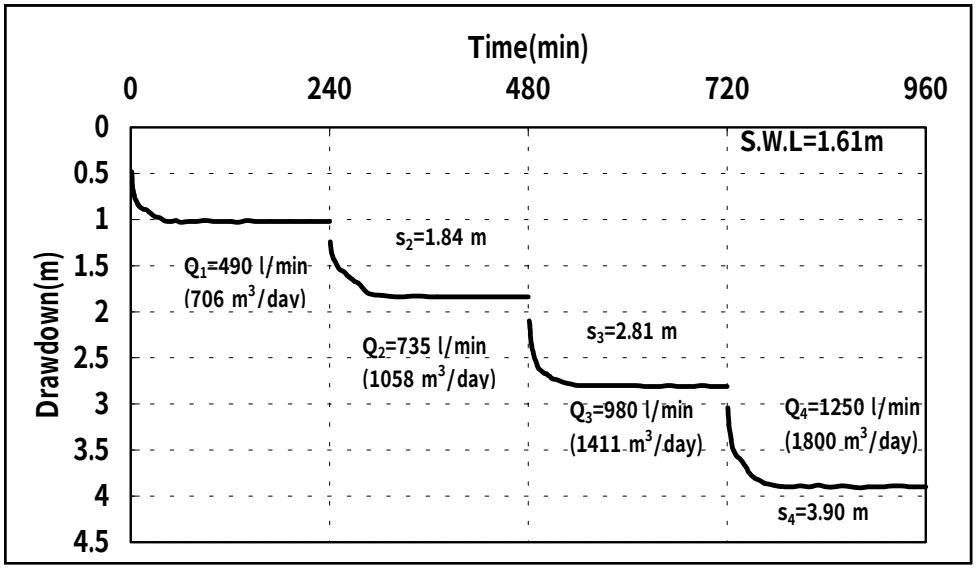
tests, so the production capacity is adopted in the project.

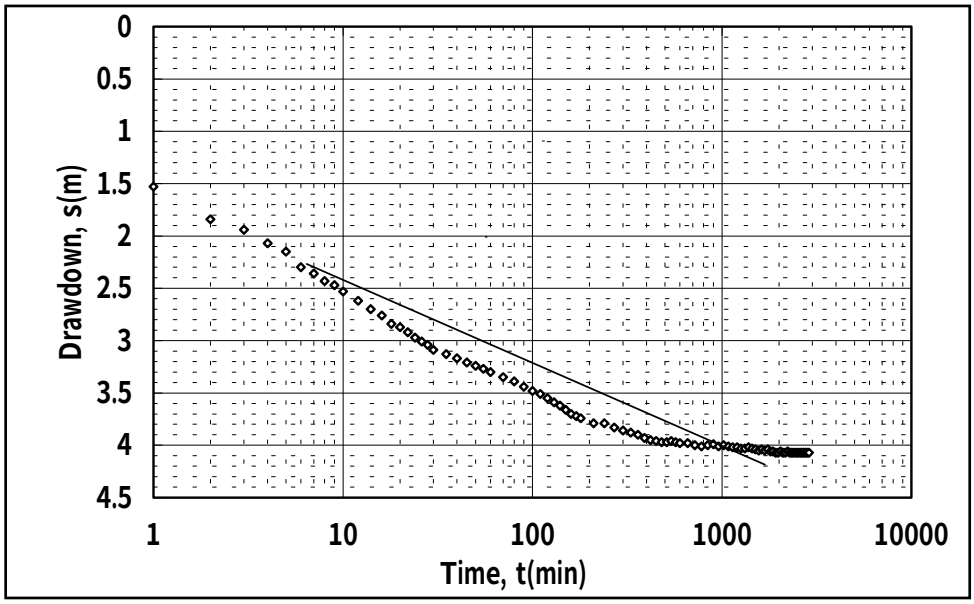
Possible intake capacity of one well and proposed well number to secure the water demand are shown in Table 3.

Table 3 Proposed Deep Wells

Province	Commune		Possible intake capacity (m^3/d)	Plan（in 2005）			
				Water demand (m^3/d)	No. of required wells (pc)	Available well No. of existing JICA wells (pc)	Required additional well No. (pc)
Thai Nguyen	1	Hoa Thuong	1,000	810	1	1	0
	2	Dong Bam	800	630	1	0	1
	3	Thinh Duc	150	350	3	1	2
	4	Nam Tien	100	475	5	1	4
Ninh Binh	5	Dong Phong	1,500	980	1	1	0
	6	Quang Son	250	510	3	1	2
	7	Yen Thang	300	870	3	0	3
Thanh Hoa	8&9	Vinh Thanh Vin Loc	1,500	1,350	1	1	0
	10	Dinh Tuong	1,700	660	1	1	0
	11	Van Ha (Thieu Hung)	1,400	760	1	1	0
	13	Van Thang	300	320	2	1	1
計：12 Communes（11 systems）				7,715	22	9	13

Note: Regarding Hoa Thuong (No.1), Dong Bam (No.2) and Yen Thang (No.7), possible intake water amount is estimated by the JICA wells and other existing wells information.





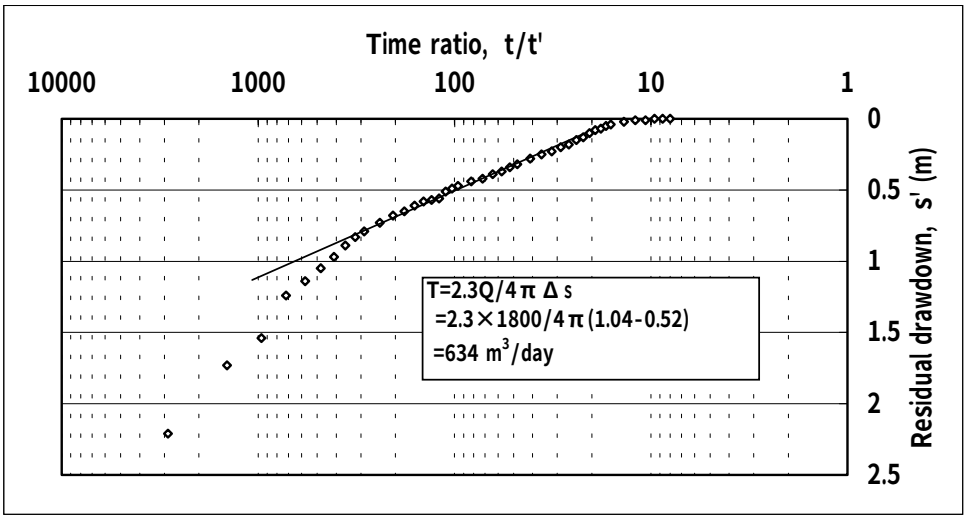
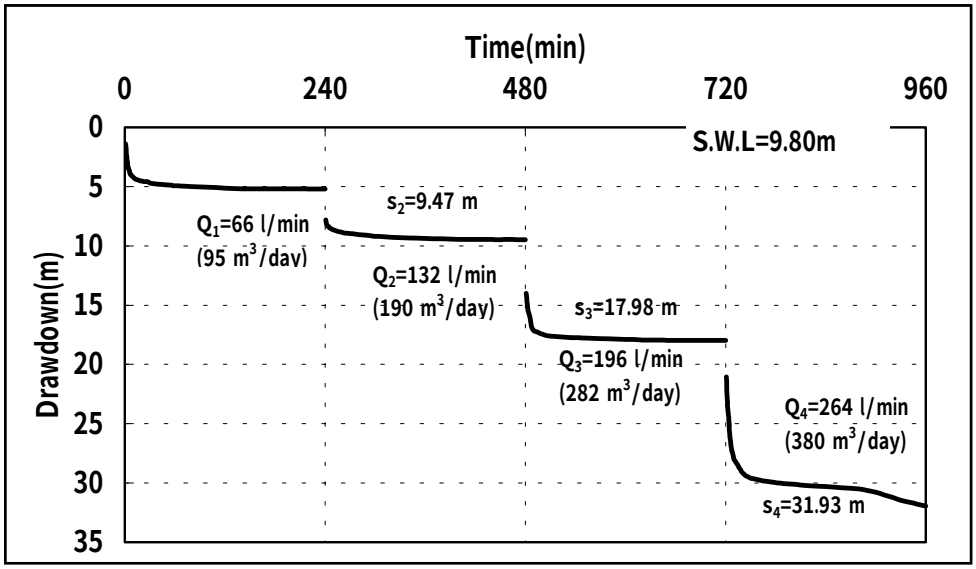
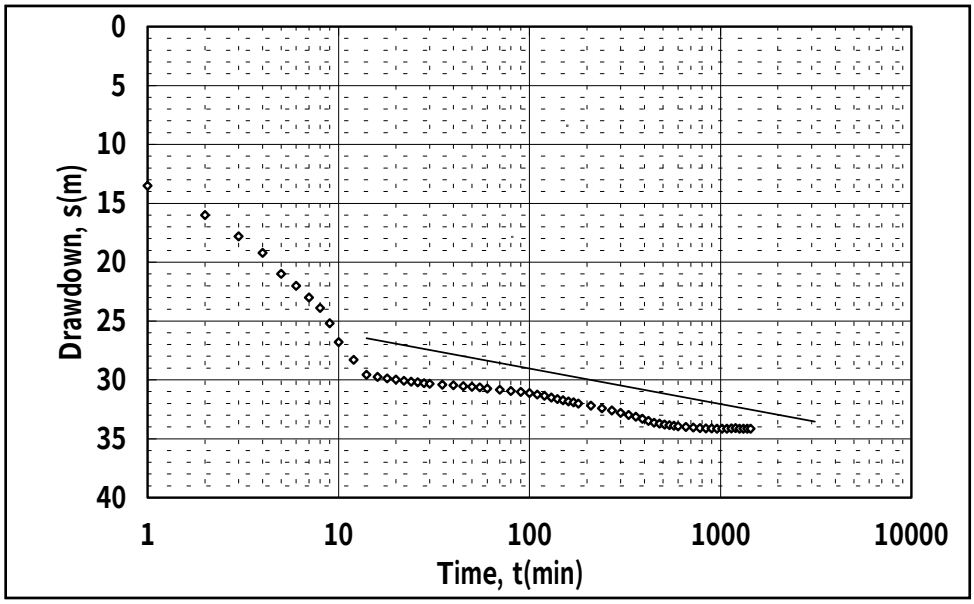


Figure 1 Result of Pumping Test at JICA -2





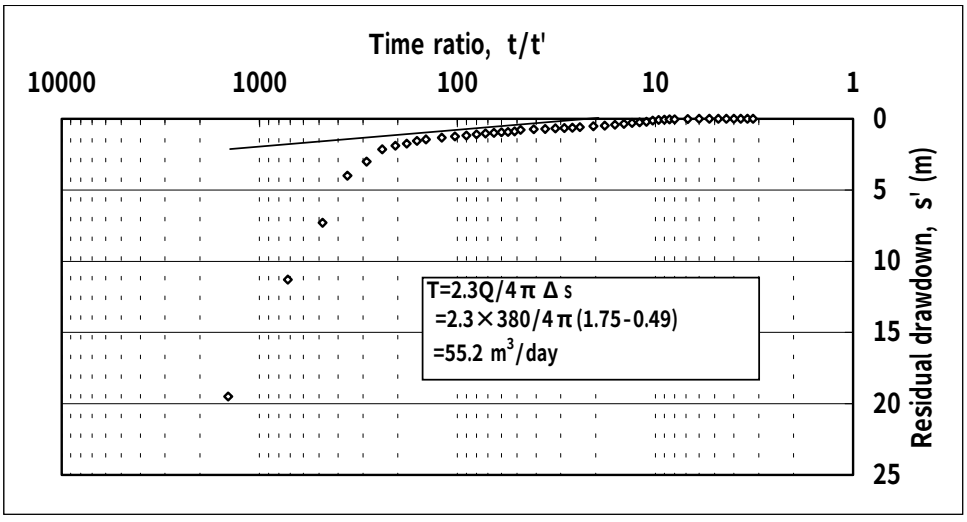
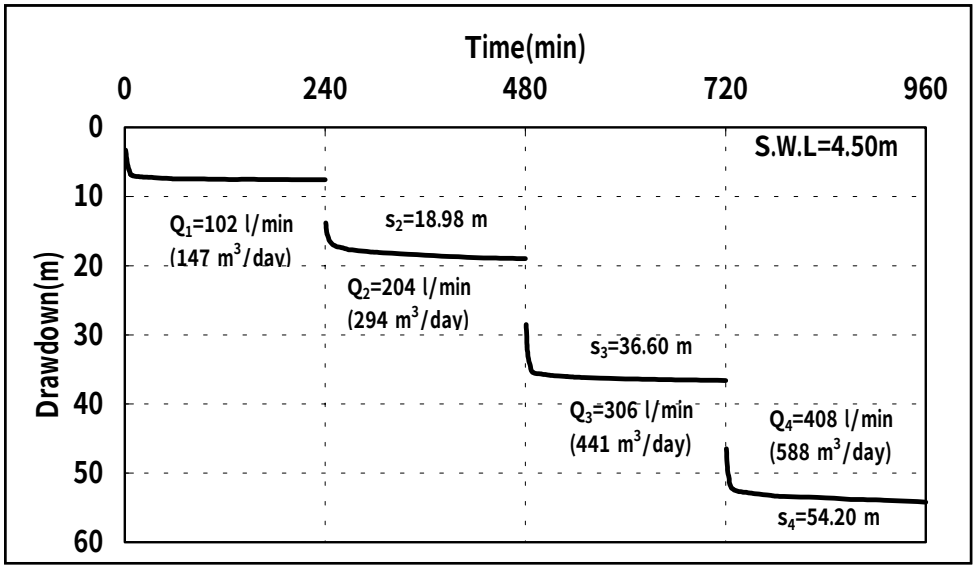
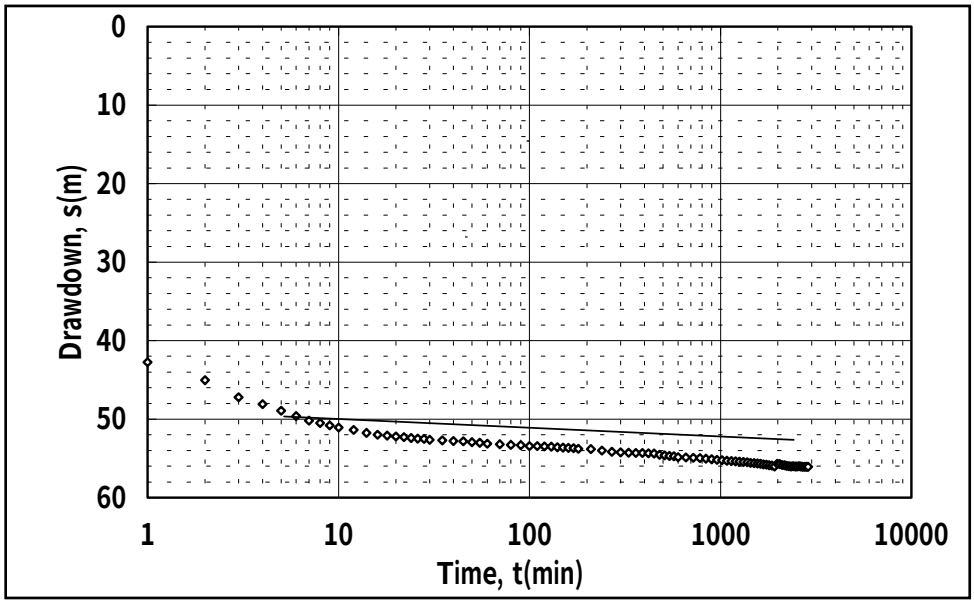


Figure 2 Result of Pumping Test at JICA -5





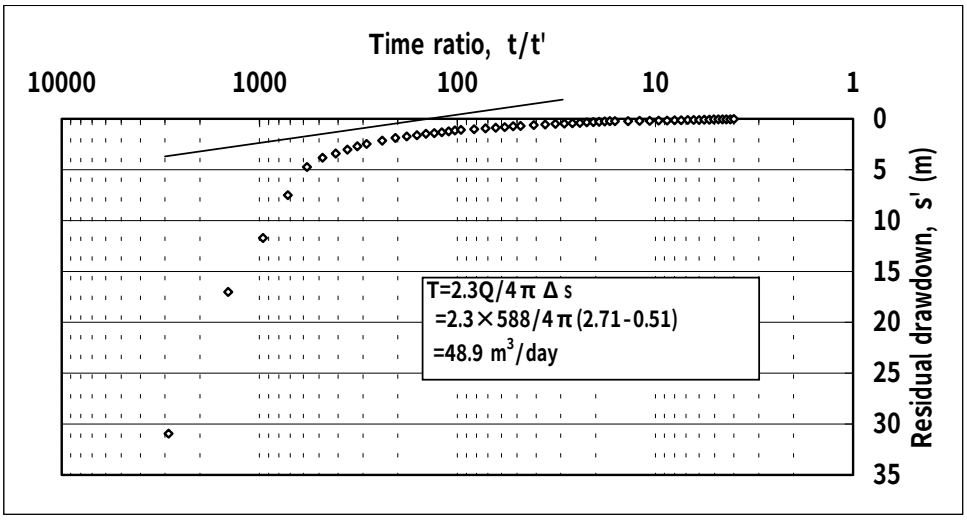
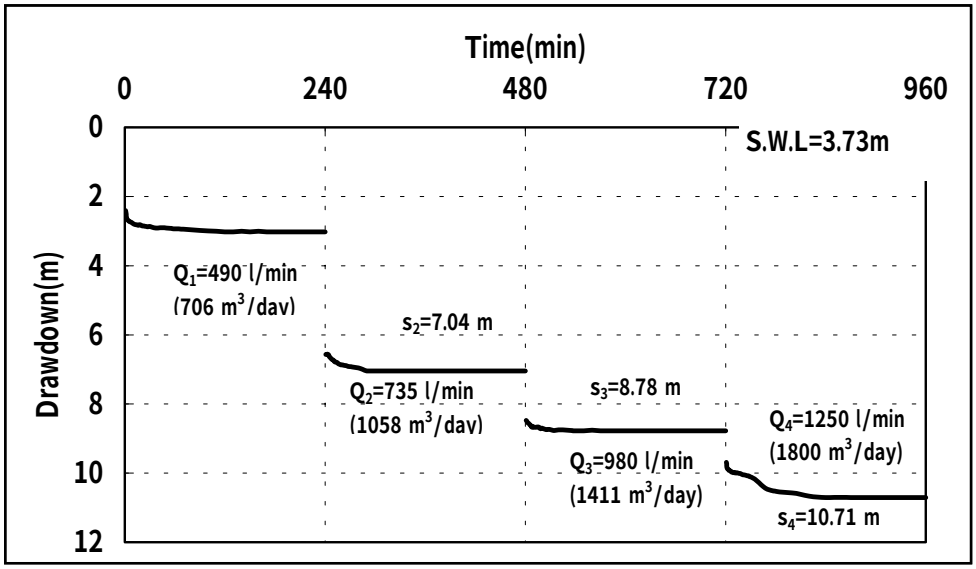
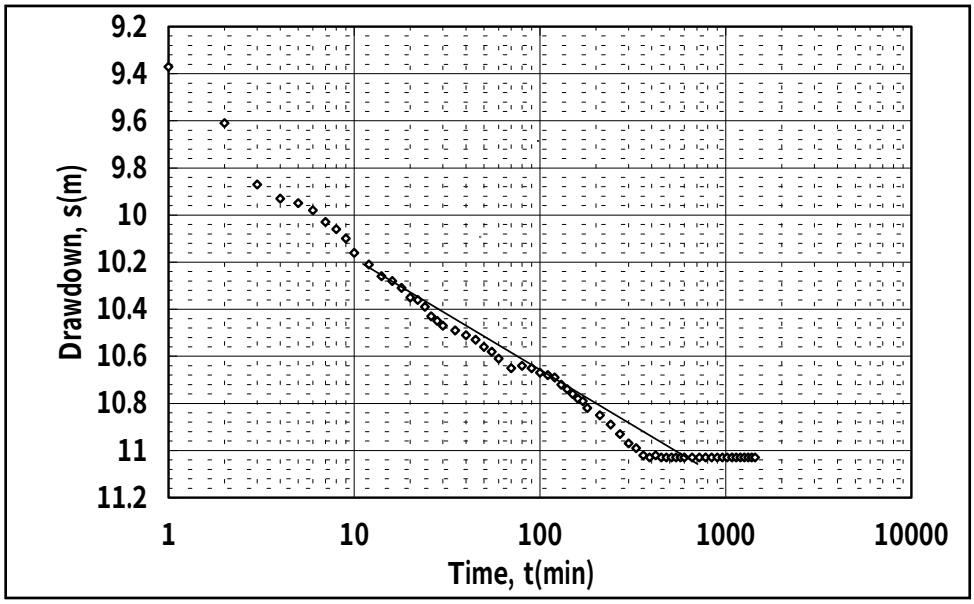


Figure 3 Result of Pumping Test at JICA -8





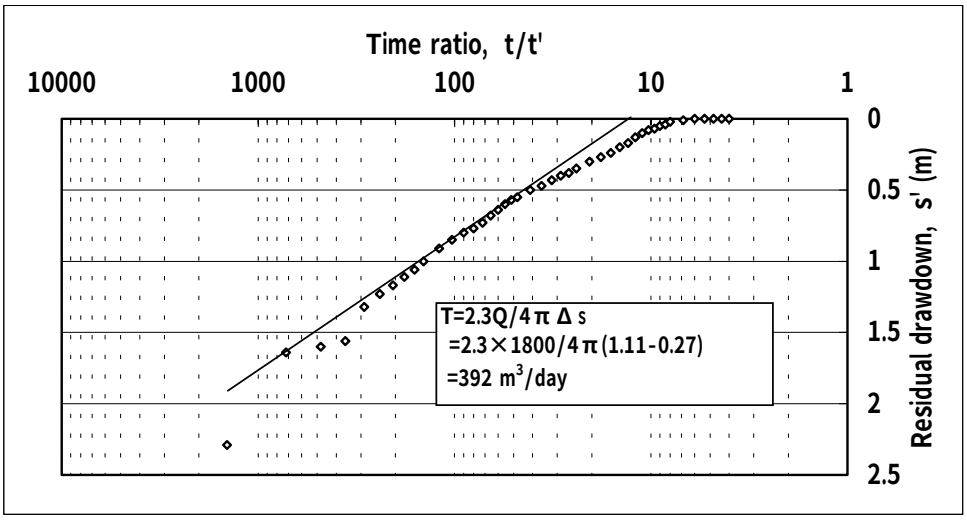
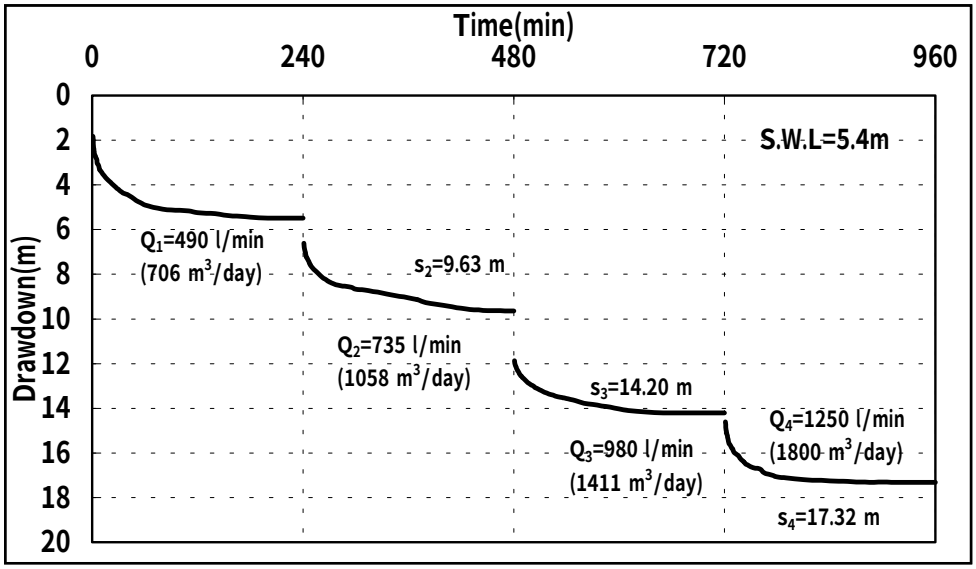
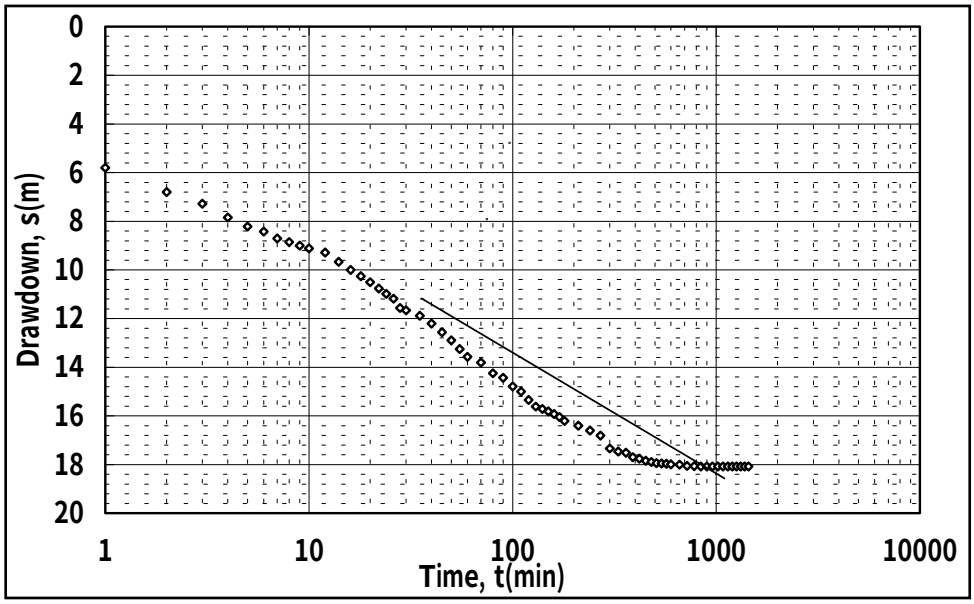


Figure 4 Result of Pumping Test at JICA -9





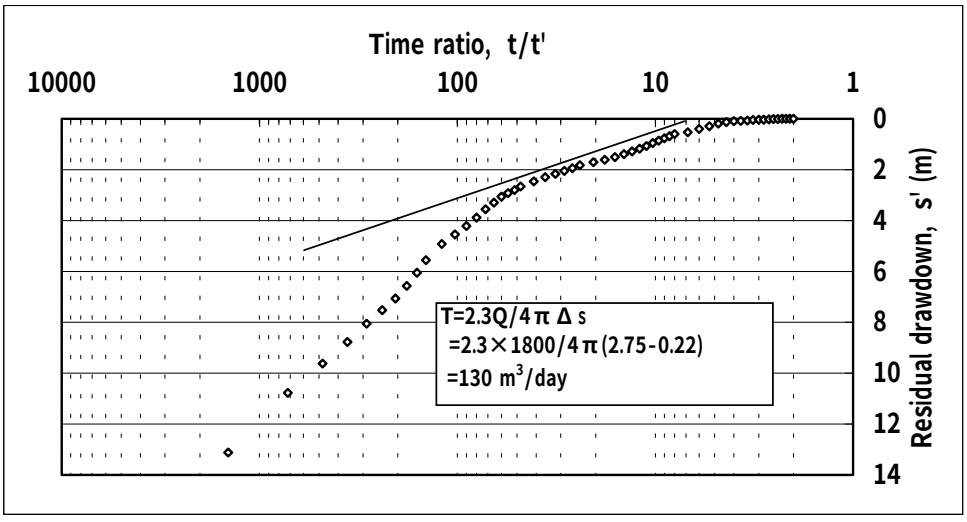
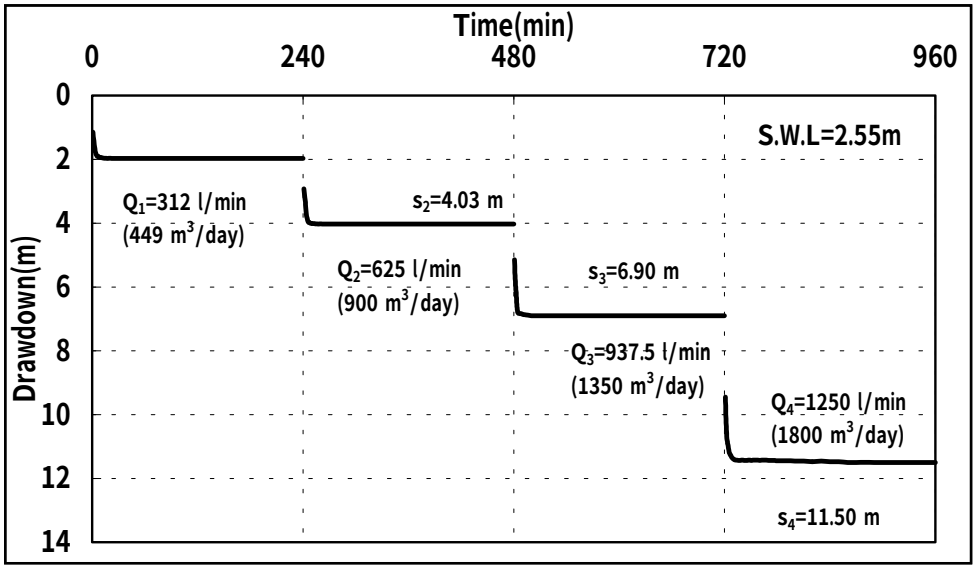
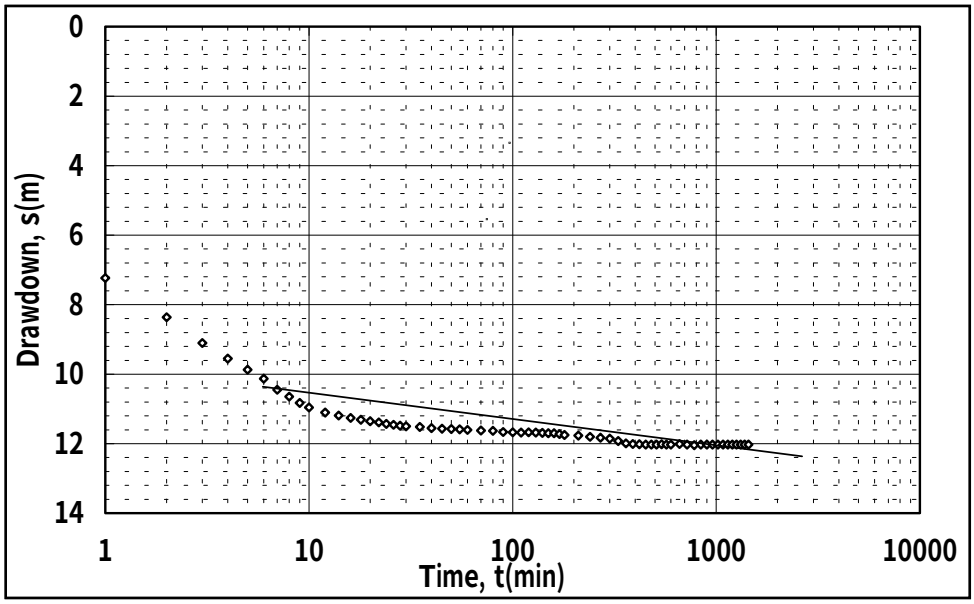


Figure 5 Result of Pumping Test at JICA -11





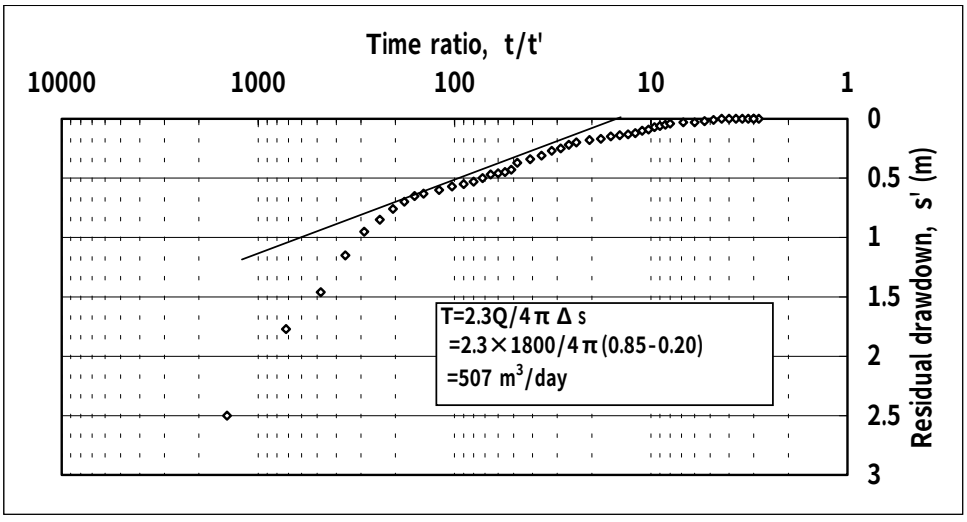


Figure 6 Result of Pumping Test at JICA -14

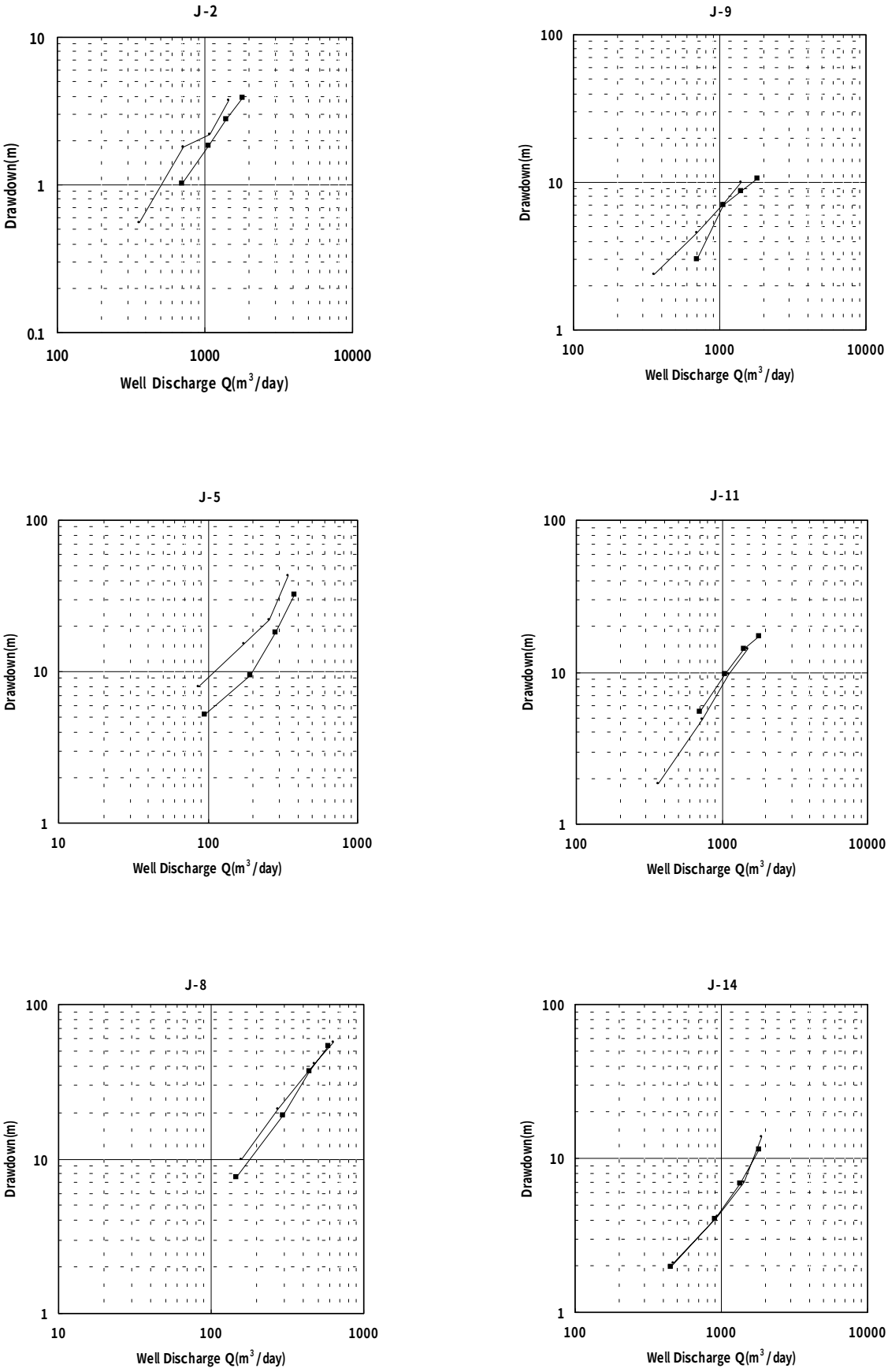


Figure 7　Result of Step Draw Down Pumping Test

[Appendix - 10] Geophysical Prospecting Survety

(1) Outline of the Survey

1) Location of Geophysical Prospecting Survey

Locations of the geophysical prospecting survey are, as mentioned in Table 1, in eight communes among three provinces, northern part in Vietnam.

2) Purpose of the Survey

The purpose of the geophysical prospecting survey is to extract the most promising part in the potential areas where aquifers might exist as a result of hydro geological survey in the project sites.

As a result of field reconnaissance, geological characters of the project sites were recognized as below:

The project sites are dominated by hard rocks, which consist of limestone, sandstone and shale. The aquifers are mainly fracture type and few layered type. If alluvium is thick, aquifers in the lower part of alluvium could be the promising target for deep groundwater intake..

3) Contents of Geophysical Prospecting Survey

The contents of the geophysical prospecting survey are shown in Table 1.

Table 1 Geophysical Prospecting Survey List

Province	Commune		Volume of Geophysical Prospecting				Geology
			Resistivity Image	Line No.	Line Length	Total	
Thai Nguyen	1	Hoa Thuong	1 pts	1	315 m	1 pts	Limestone
	2	Dong Bam	1 pts	2	315 m	1 pts	Limestone
	3	Thinh Duc	2 pts	3	315 m	2 pts	Sandstone・Shale
				4	315 m		
	4	Nam Tien	1 pts	5	315 m	1 pts	Sandstone・Shale
Ninh Binh	6	Quang Son	1 pts	6	395 m	1 pts	Limestone
	7	Yen Thang	1 pts	7	315 m	1 pts	Limestone
Thanh Hoa	8 & 9	Vinh Thanh & Vinh Loc	1 pts	8	315 m	1 pts	Limestone&Shale
	13	Van Thang	2 pts	9	395 m	2 pts	Sandstone・Shale
				10	315 m		
Total			10 pts	-	3,310 m	10 pts	

(2) Survey Method

1) Applied Method of Geophysical Prospecting Survey

As a result of field reconnaissance, geological characters are recognized as below.

The project sites are dominated by hard rocks consist of limestone, sandstone and shale. The aquifers are mainly fracture type and not layered type. The thickness of overburden consists of alluvium in project sites and varies from 10 m to 20 m. In the previous groundwater development survey, quality aquifers had been captured in lower alluvium less than 50 m in depth. Then the thicker alluvium area is also considered as the promising area. Because fractures in the hard rocks located beneath alluvium continues from shallow part to deep part, resistivity profile from ground surface to 50 m in depth can show the position of fractures continuing to the deeper part.

Therefore the Resistivity Image Profiling (RIP) with sounding depth of 50 meters was applied in this survey. RIP can detect both aquifers of fractured type and layered type. The aim of RIP is to grasp the position of the fault and structure of alluvium from the resistivity image profile along survey line and to help locating of the deep well boring targeting those aquifers. The survey line of the resistivity image profiling was located the high potential area where fracture type aquifers in hard rocks or layered aquifers in lower alluvium could exist from results of hydrogeological survey. The direction of profiling was set up to cross to expected geological structure and specially fault structure at right angles.

2) Outline of the Resistivity Image Profiling

In the Resistivity Image Profiling, 64 electrodes connected with electric cables to the receiver-transmitter were put on the ground with 5 m each spacing. In RIP, applied electrodes configuration would be modified in Wenner array, Schlumberger array, and also applied n value would be modified from 1 to 16 automatically and taken measurement repeatedly. Several hundreds points of measurements on profile would be taken effectively in one procedure. The sequence of the electrode arrangement and spacing was decided in consideration of the target for the prospecting, sounding depth, a resolution and working productivity, and programs prepared in advance, and carried out in order.

The measurement result was downloaded from the receiver to the personal computer, and processed with data of the electrode configuration, and transferred to data set for inversion in the personal computer. A two-dimensional inversion was carried out, and result of it could show a two-dimensional resistivity structure on profile. Wenner-Schlumberger array with 64 electrodes with 5 meters spacing was applied.

3) Location of Geophysical Prospecting Survey

- The horizontal position of the central point of each profile was measured by GPS.
- Though the elevation above the sea water level of center point was measured by GPS too, it w as omitted because precision of it was not secured without anaccurate topographical map. The

center positions of profile measured with GPS are shown in the Table 2.

Table 2-1 Survey Line Position

Line No.	Date	Province	Commune		Longitude East		Latitude North		UTM X	UTM Y
					Deg	Min	Deg	Min	meters	meters
1	6/18	Thai Nguyen	1	Hoa Thuong	105	49.962	21	39.533	586,144	2,395,100
2	6/19	Thai Nguyen	2	Dong Bam	105	50.525	21	36.143	587,153	2,388,865
3	6/20	Thai Nguyen	3	Thinh Duc	105	48.261	21	32.842	583,284	2,382,747
4	6/22	Thai Nguyen	3	Thinh Duc	105	48.270	21	32.084	583,295	2,381,345
5	6/21	Thai Nguyen	4	Nam Tien	105	52.699	21	23.751	591,030	2,366,019
6	6/14	Ninh Binh	6	Quang Son	105	53.316	20	9.101	592,854	2,228,333
7	6/15	Ninh Binh	7	Yen Thang	105	57.006	20	8.291	599,284	2,226,876
8	6/25	Thanh Hoa	8 & 9	Vinh Thanh & Vinh Loc	105	37.446	20	2.824	565,256	2,216,629
9	6/26	Thanh Hoa	13	Van Thang	105	37.088	19	37.147	564,805	2,169,274
10	6/27	Thanh Hoa	13	Van Thang	105	37.513	19	37.301	565,544	2,169,555

4) Simulation Analysis of Resistivity Structure

The resistivity structure obtained in the simulation analysis is the two-dimensional body supposed to continue infinitely across the survey line. And, because the direction of survey line is set to cross the fault, the two-dimensional simulation analysis is suitable for the extraction of the fault structure.

At first the model which is supposed to present resistivity close to observed resistivity was made, and resistivity of the model was calculated by finite element method. Next, though the model was modified compared between calculated resistivity and observed resistivity, modification of model was done repeatedly at the least square method under the restraint condition that resistivity of the model changed smoothly. The resistivity structure model which shows calculated apparent resistivity, which approximates observed apparent resistivity, was found finally.

(3) Results of Geophysical Prospecting Survey

a) Line-1 in Hoa Thuong

Geological main strike in this area is the direction of NW-SE. The survey line was set up in the direction of ENE-WSW across the strike with high angle along the road. The intersection of the survey line and another pebble road, which extends in the direction of NW-SE, is located at the 100 meters in distance from the north end of the survey line. The intersection is located on a topographical boundary, a small hill exists in the east of the intersection and rice field is spreading out in the west of the intersection. A top of another small hill exists at the point of 200 meters in distance from eastern end.

As the results of the simulation analysis, high resistivity zone whose center is located in the distance 120 meters from eastern ends goes up from deep part of the ground. It is considered that a kind of boundary exists at near the boundary between high resistivity zone and low resistivity zone. The western area of the boundary is located close to creek and expected to be supplied water from the groundwater near surface. There is a promising point for deep well in the western area of the boundary.

b) Line-2 in Dong Bam

The survey line was set up along the main road in the flat rice fields, and the measurement was carried out along the narrow trail road between the main road and the muddy path in the irrigated rice fields. Some dome-shaped limestone bodies are dotted around town of Dong Bam Commune. They are seemed to make lines in the direction of NW-SE. The survey line was laid out to go cross the extension line of limestone.

The survey result shows that the high resistivity zone goes up from deep part of the ground in the distance 150 meters from southern ends. This shows that high resistivity layer goes up from deep part of the ground in the distance 150 meters from southern ends. It is estimated that the high resistivity layer is possibly limestone. The fracture zones are developed in the both sides of the high resistivity layer, and fracture zones are promising as an aquifer of fracture type.

c) Line-3 in Thinh Duc

The survey line was arranged along the main road going through the hilly country. The hills show continuity in the direction of NW-SE. The valleys among the hills are the irrigated rice field. The intersection of the survey line and unpaved road stretched in the direction of NW-SE is located at about 50 meters in distance from northern ends.

Hills show continuity in the NW-SE direction, and valleys among hills are the irrigated rice field. A point of intersection with the unpaved way that it grows in the survey line and NW-SE is the point of about 50 m from the northern end.

As the results of the simulation analysis, the earth has roughly layered resistivity structure. That includes three layers of high resistivity layer, low resistivity layer, high resistivity layer from top to bottom. The vertical resistivity boundary which suggests fracture zones is not recognized. It is difficult on Line-3 to point out the area where fracture type aquifers exists with high potential. Then the area where alluvium lies thicker is pointed out as the most promising area. That is located at distance of 100 meters from the north ends of Line-3.

d) Line-4 in Thinh Duc

The survey Line-4 was arranged along the same road away about 4 kilometers south from Line-3. Line-4 is located in the hilly country where hills show continuity in the direction of NW-SE like Line-3, and valleys among hills are the irrigated rice field. The point where Line-4 intersects with unpaved road of the direction of NW-SE is located at about 50-meter distance from the northern end.

As the results of the simulation analysis, the earth has roughly layered resistivity structure. That includes three layers of high resistivity layer, low resistivity layer, high resistivity layer from top to bottom. The second layer contains a vertical gap where the resistivity boundary exists at distance of 180 meters from the southeastern ends. The fracture type aquifer exists at the gap with high potential. Then it is considered that the most promising area is located at distance of 180 meters from the southeastern ends of Line-4.

e) Line-5 in Nam Tien

The survey line was arranged along the unpaved road that goes through irrigated rice field. As the results of the simulation analysis, the earth has roughly layered resistivity structure. That includes three layers of high resistivity layer, low resistivity layer, high resistivity layer from top to bottom. The earth shows low resistivity in general. It is considered that the earth resistivity was decreased by rain just before taking measurement.

The vertical resistivity boundary is recognized at the vicinity of 185 meters from western end of Line-5. Though the resistivity boundary is not clear because that does not consist of big resistivity contrast, the fracture type aquifer is most likely to exist on Line-5. Then it is estimated that the most promising point exists at vicinity of 185 meters in distance from western end of Line-5.

f) Line-6 in Quang Son

The survey line was arranged along flat unpaved road in the hill country. As the results of the simulation analysis, the earth has layered resistivity structure. That includes two layers of low resistivity layer, high resistivity layer from top to bottom. A kind of saddle structure consisting of high resistivity layer exists in the vicinity of 160 meters in distance from northern end of Line-6. The fracture type aquifer can exists at this saddle structure with high possibility. Then, it is estimated that the most promising point exists at vicinity of 160 meters in distance from northern end of Line-6.

g) Line-7 in Yen Thang

There is a long lake in the NW-SE direction in the southern part of Yen Thang Commune. The bulge of dome-shaped limestone surrounds the lake and continues in the NW-SE direction. The survey line was

arranged along unpaved road in the ENE-WSW direction to cross with the extension line of limestone.

As the results of the simulation analysis, the earth has roughly layered resistivity structure. That includes two layers of low resistivity layer, high resistivity layer from top to bottom. The boundary of these two layers is not flat. The high resistivity zone rises up from the deeper part at 150 meters in distance from northern end of Line-7, on the other hand the low resistivity zone sinks down from near the surface at 170 meters in distance from northern end of Line-7. The fracture type aquifer can exist at the vicinity of these boundaries with high possibility. The thicker alluvium can exist at the sinking area of low resistivity zone with high possibility. Then, it is estimated that the most promising point exists at vicinity of 165 meters in distance from northern end of Line-7.

h) Line-8 in Vinh Thanh

The lineament in the NW-SE direction is recognized clear in the mountain that exists in the center of Vinh Thanh Commune and consists of shale. It is expected that geological boundary or fault exists in the southern side of the mountain. The survey line was arranged to cross with the extension of geological boundary or fault along unpaved road. The road lies in the N-S direction in contact with the western edge of the mountain.

As the results of the simulation analysis, the earth has roughly layered resistivity structure. That includes two layers of low resistivity layer, high resistivity layer from top to bottom. The low resistivity layer goes under the deeper high resistivity layer from northern side of Line-8. The fracture type aquifer can exist in the vicinity of boundary between the high resistivity layer deeper than 30 meters in depth and the low resistivity layer existing deeper with high possibility. The deep well must be planned at 110 meters in distance from southern end of Line-8 to capture this aquifer. Then, it is estimated that the most promising point exists at vicinity of 110 meters in distance from southern end of Line-8.

i) Line-9 in Van Thang

A mountain exists in the southeastern part of Van Thang Commune and consists of sandstone or shale. Because the lineament in the NW-SE direction is recognized in that mountain, the fault is expected near the lineament. The survey line was arranged to cross with the extension of the lineament along unpaved road in the N-S direction running through the flat irrigated rice field.

As the results of the simulation analysis, the earth has roughly layered resistivity structure. That includes three layers of high resistivity layer, low resistivity layer, high resistivity layer from top to bottom. The vertical resistivity boundary which suggests fracture zones is not recognized. It is difficult on Line-9 to point out the area where fracture type aquifers exist with high potential. Then the

area where alluvium lies thicker is pointed out as the most promising area. That is located at distance of 180 meters from the south end of Line-9.

j) Line-10 in Van Thang

This survey line exists in Van Thang Commune apart about 1-km east from Line-9 and same other geological and topographical conditions surround it.

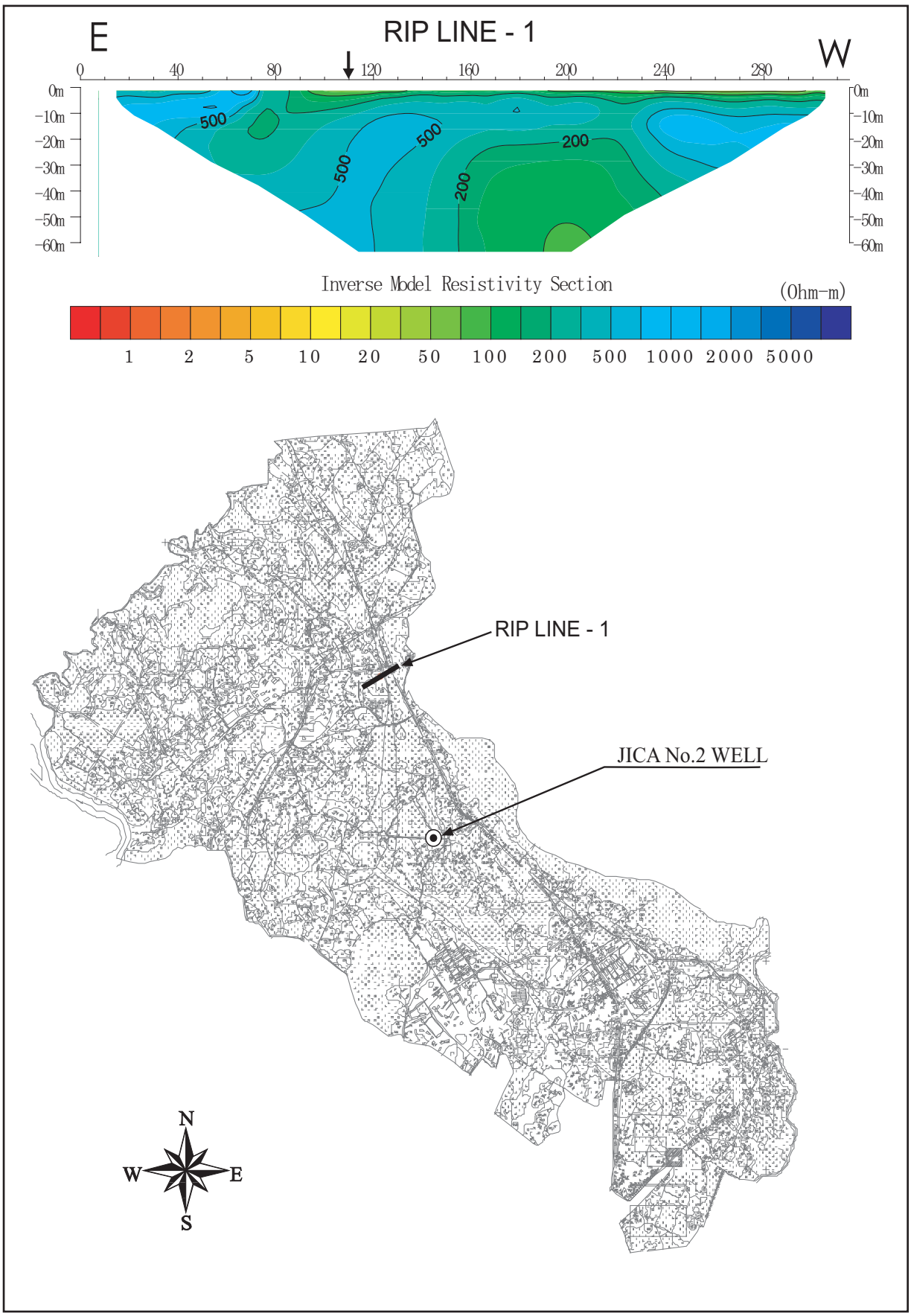
As the results of the simulation analysis, the earth has roughly layered resistivity structure. That includes three layers of high resistivity layer, low resistivity layer from top to bottom. The earth deeper than 20 meters is divided to southern part of 70 to 100 ohm-m in resistivity and northern part of 100 to 141 ohm-m in resistivity. The vertical resistivity boundary that exists at 150 meters in distance from northern end of Line-10 suggests fracture zones. Then, it is estimated that the most promising point exists at vicinity of 150 meters in distance from northern end of Line-10.

(4) Planning for Deep Well

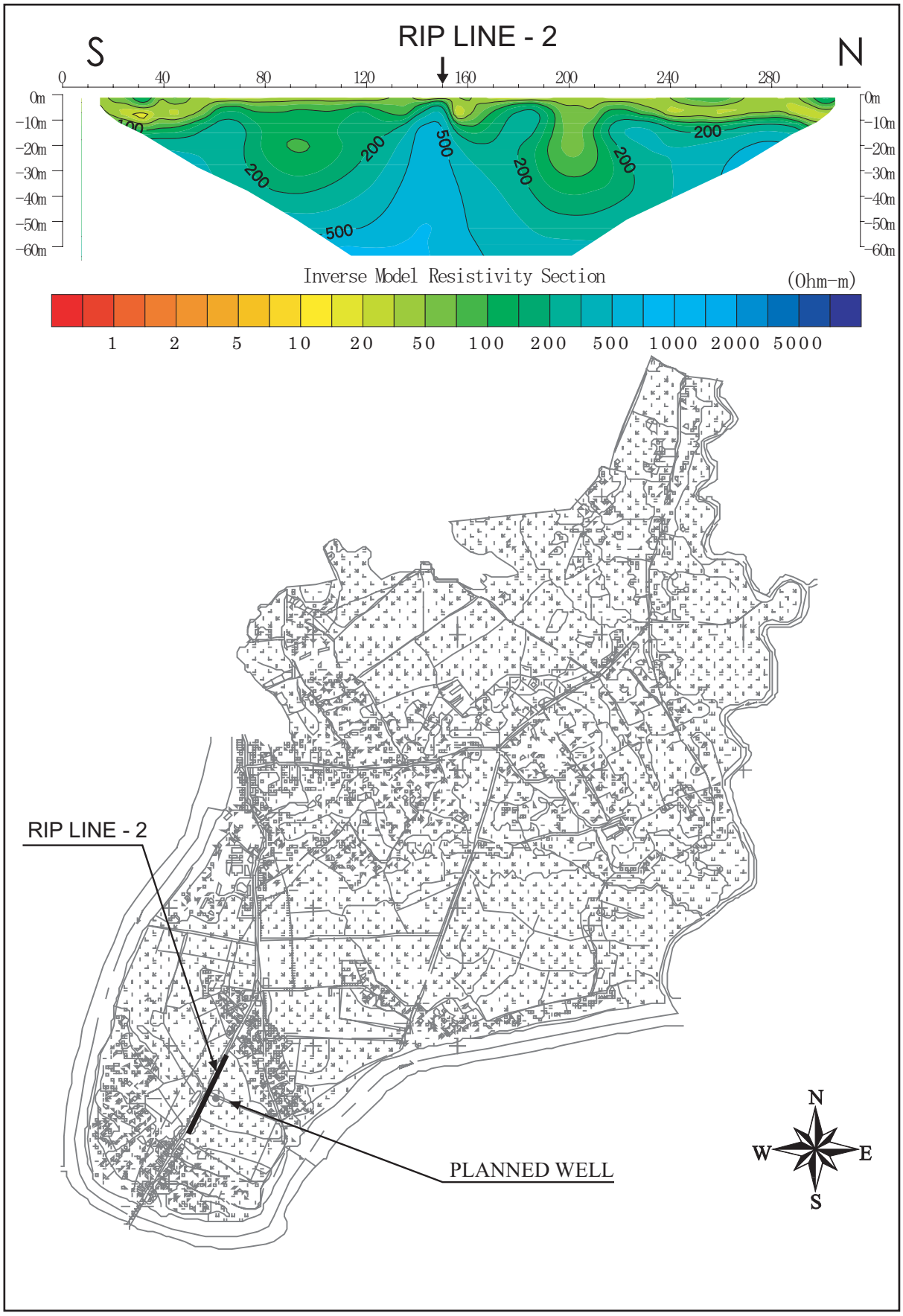
The promising points for well construction is shown in Table 3, as geophysical investigation result.

Table 3 Proposed Well Point

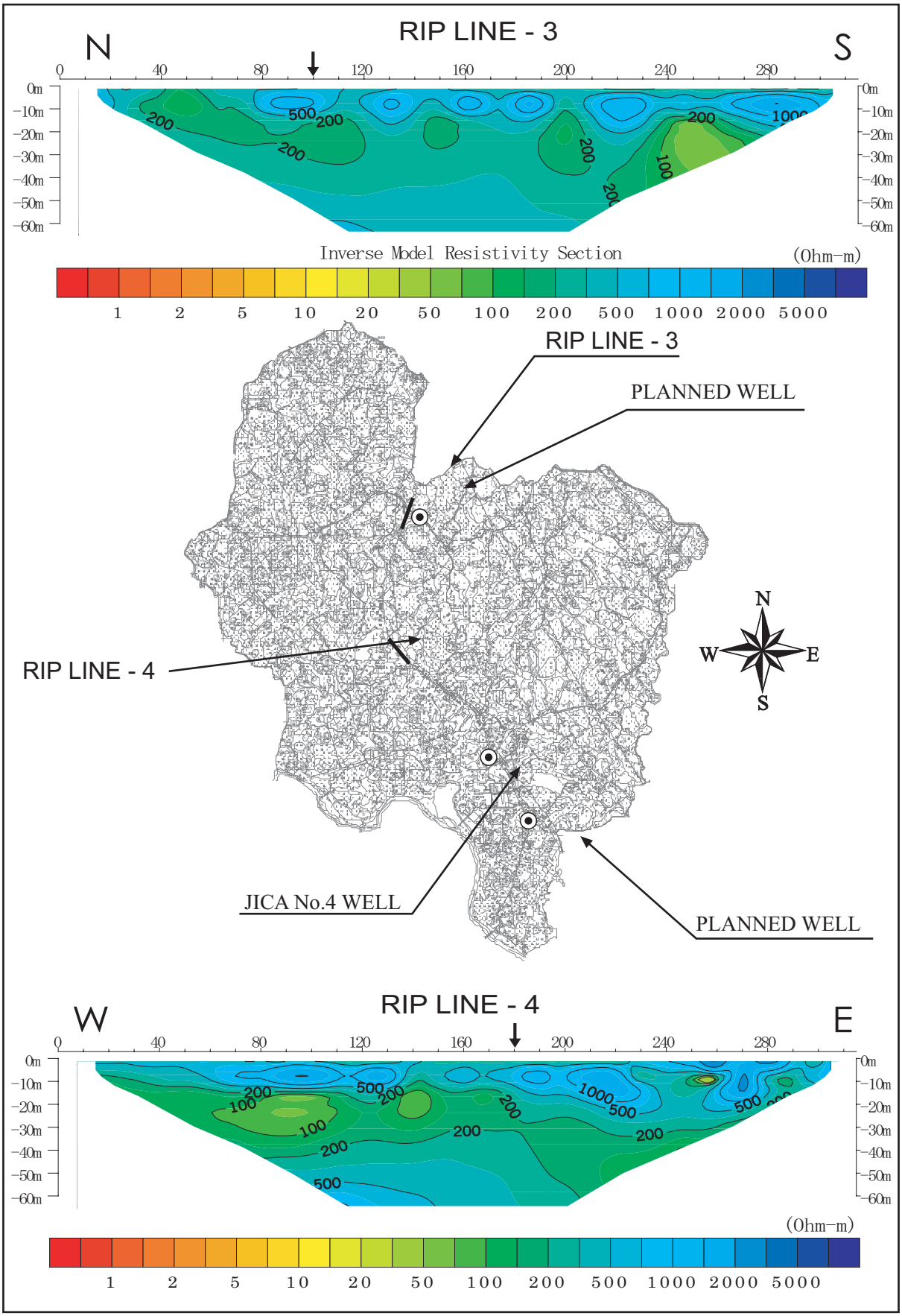
Province	Commune		Line	Promising Point		Geology	Comments
Thai Nguyen	1	Hoa Thuong	1	apart 120 m	from Eastern end	Limestone	Low resistivity zone correspond to stream
	2	Dong Bam	2	apart 150 m	from South western end	Limestone	Low resistivity zone correspond to Lineament
	3	Thinh Duc	3	apart 100 m	from Northern end	Sandstone/ Shale	Low resistivity zone correspond to stream
			4	apart 165 m	from Southern end		Thicker part of Low resistivity layer
	4	Nam Tien	5	apart 185 m	from western end	Sandstone/ Shale	Low resistivity zone correspond to Lineament
Ninh Binh	6	Quang Son	6	apart 155 m	from Northern end	Sandstone/ Shale	Low resistivity zone correspond to Lineament
	7	Yen Thang	7	apart 160 m	from Northern end	Limestone	Low resistivity zone correspond to Lineament
Thanh Hoa	8 & 9	Vinh Thanh & Vinh Loc	8	apart 80 m	from Southern end	Sandstone & Shale	Apart 60 m from the survey line taking effect to existing well into account
	13	Van Thang	9	apart 180 m	from Northern end	Sandstone/ Shale	Thicker part of Low resistivity layer
			10	apart 150 m	from Northern end		Resistivity Boundary



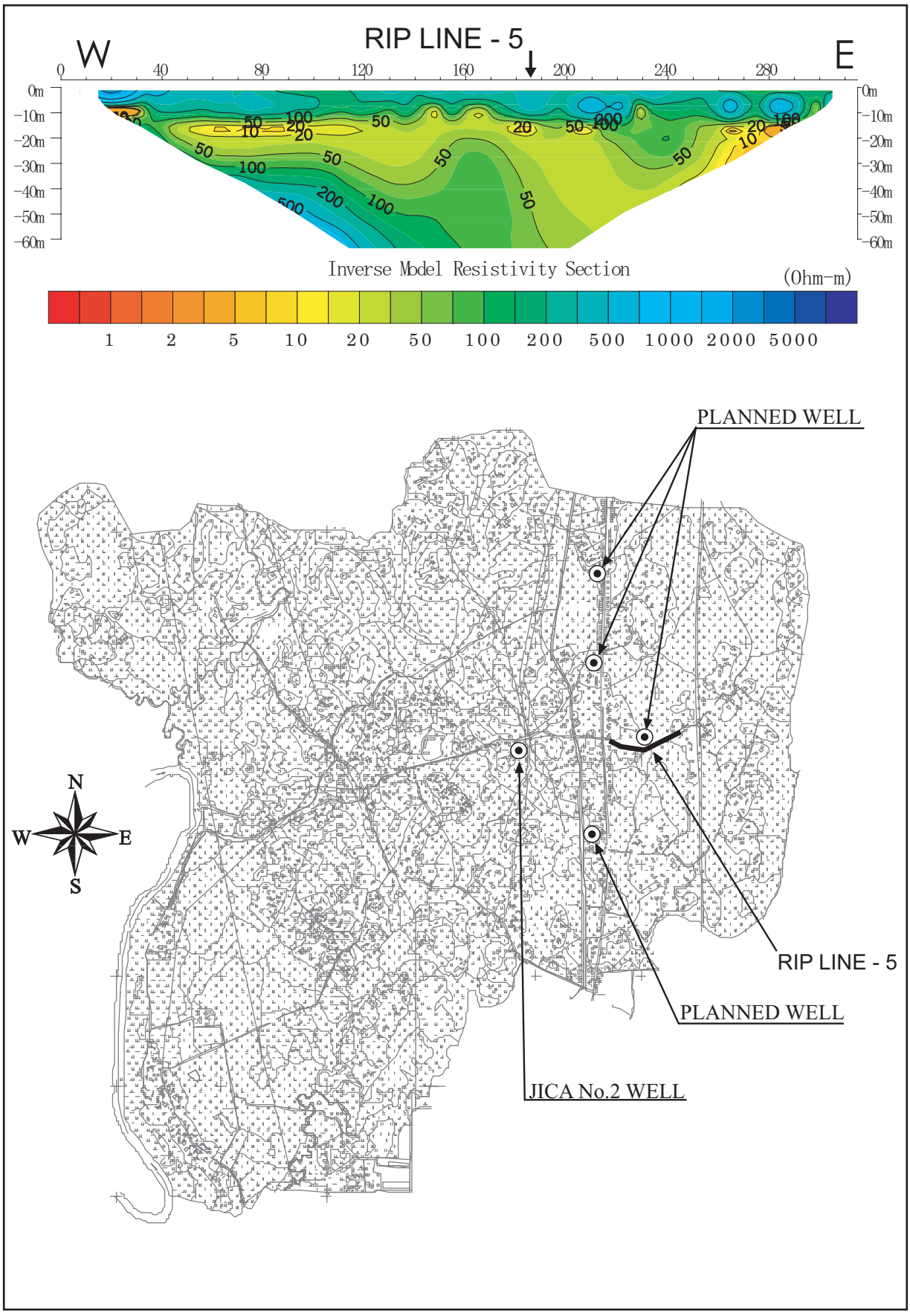
Location of Resistivity Image Profile on Line - 1
in Hoa Thuong Commune,Thai Nguyen Province



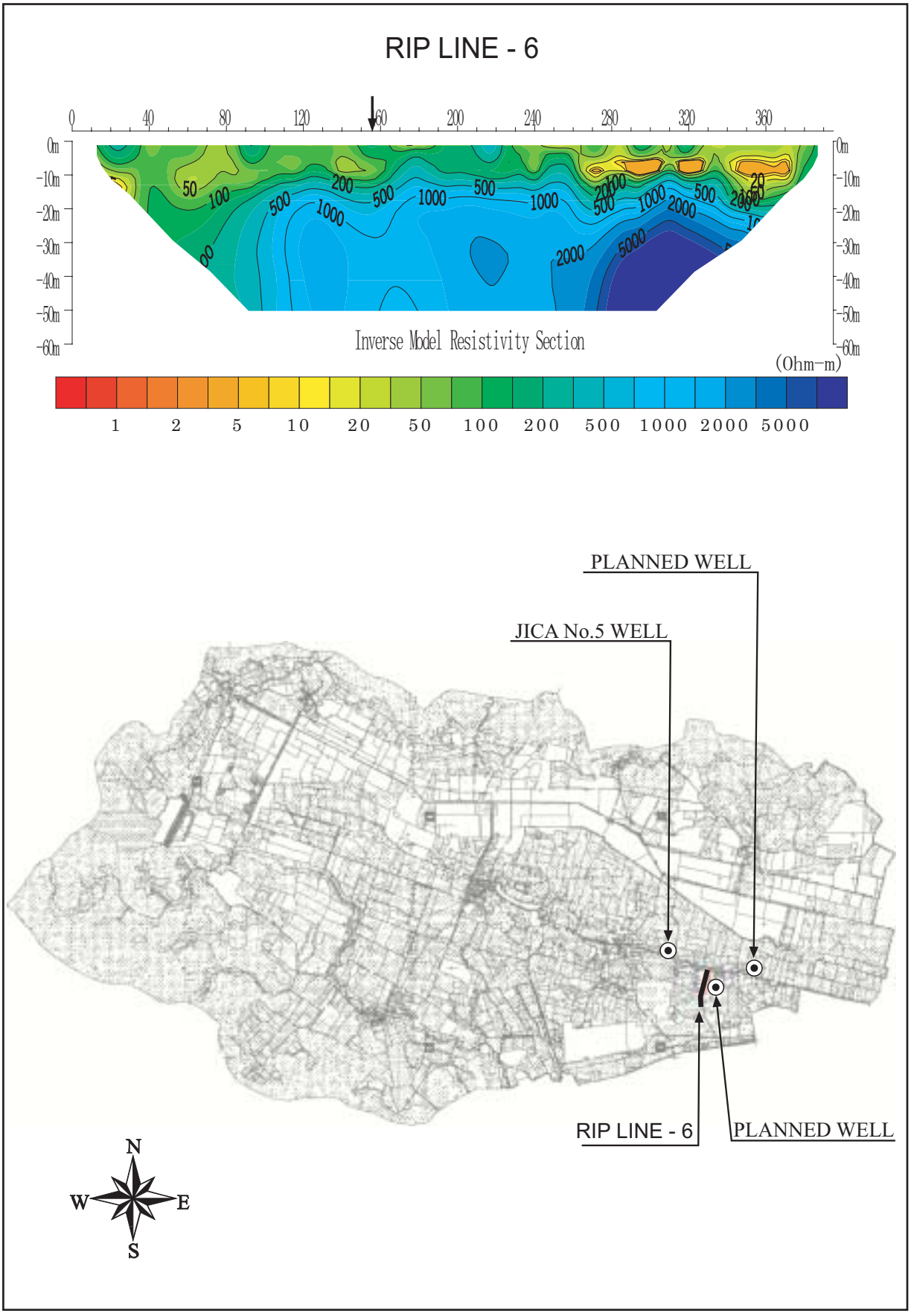
Location of Resistivity Image Profile on Line - 2
in Dong Bam Commune, Thai Nguyen Province



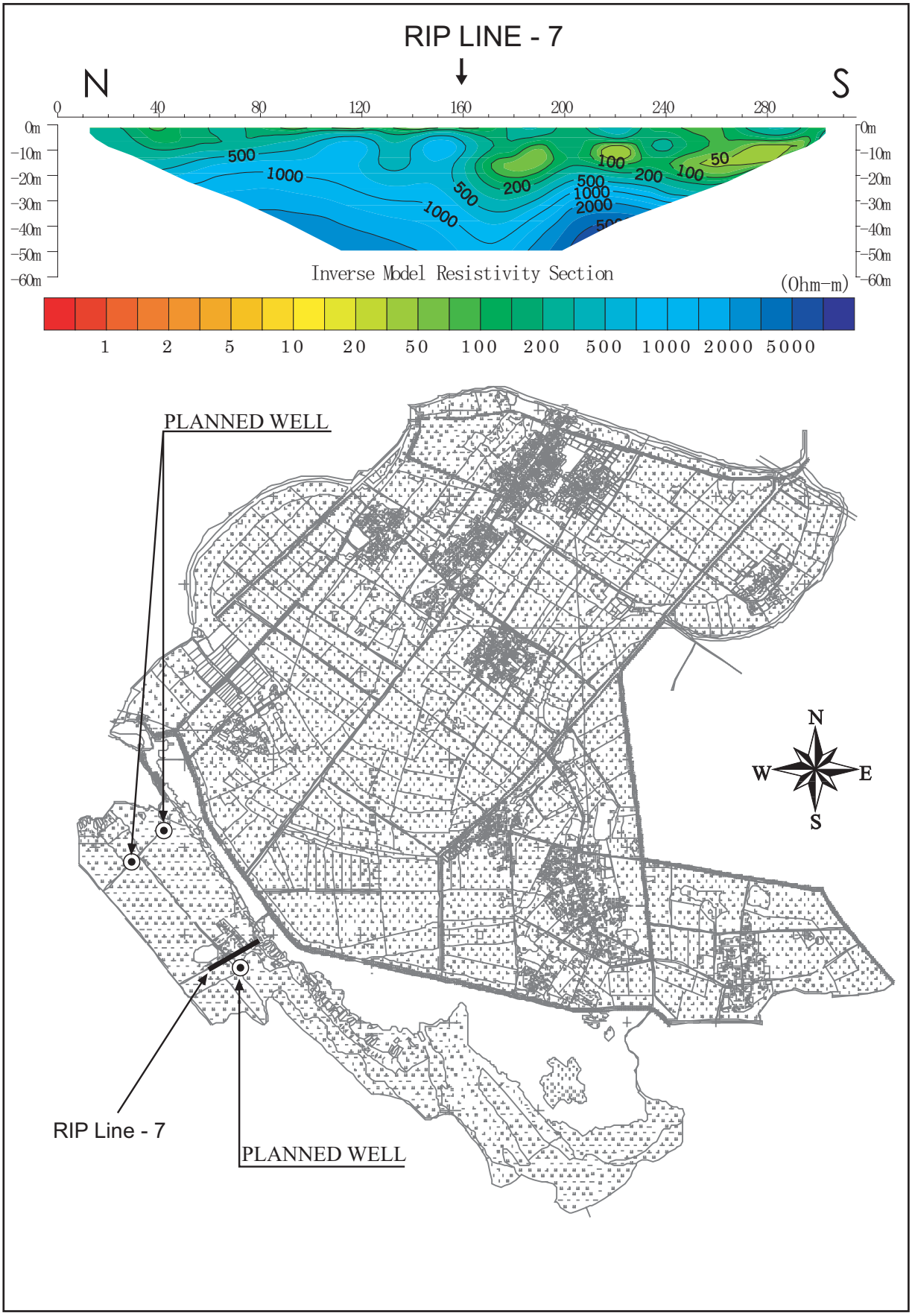
Location of Resistivity Image Profile on Line - 3 & 4
in Thinh Duc Commune, Thai Nguyen Province



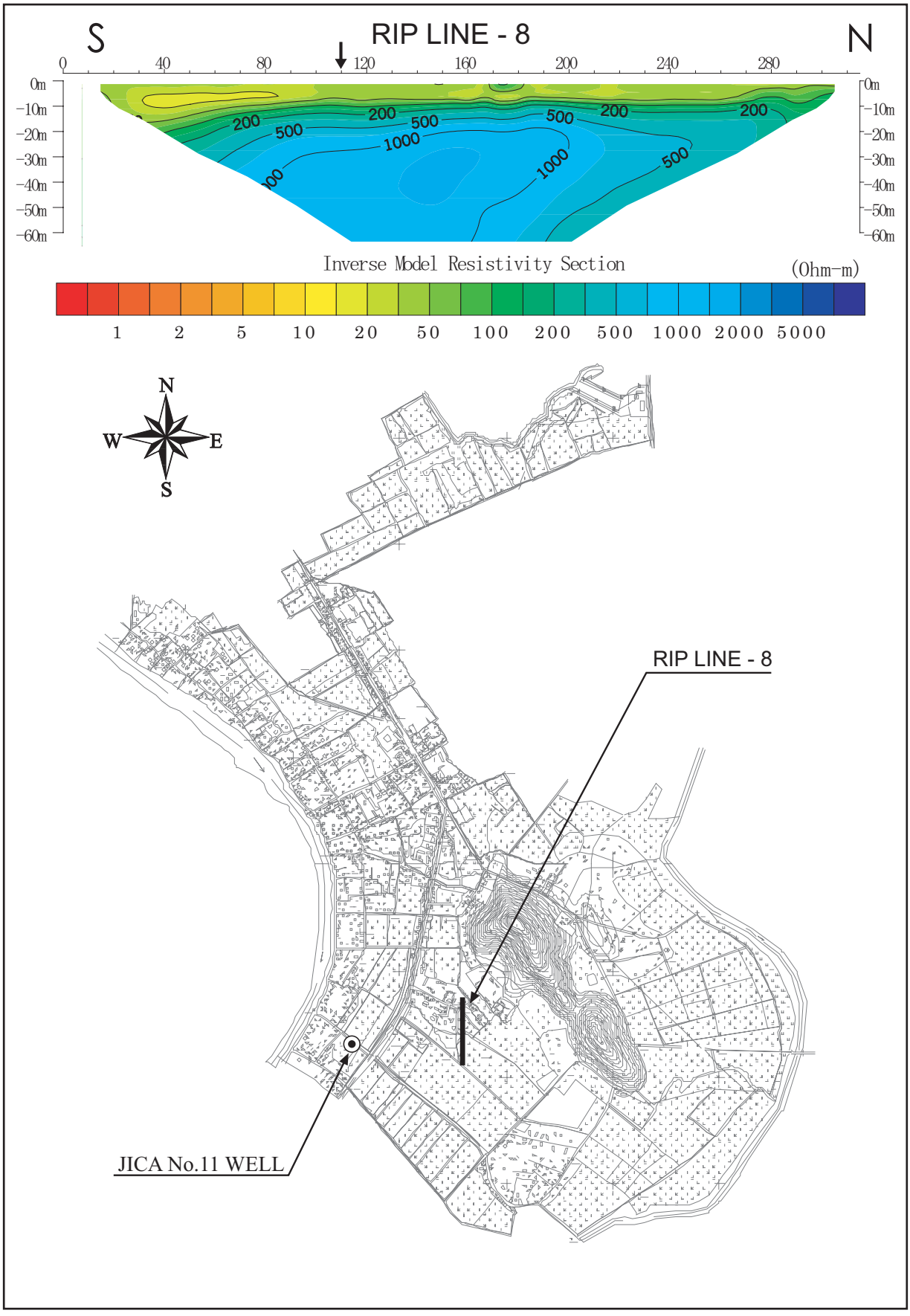
Location of Resistivity Image Profile on Line - 5
in Nam Tien Commune, Thai Nguyen Province



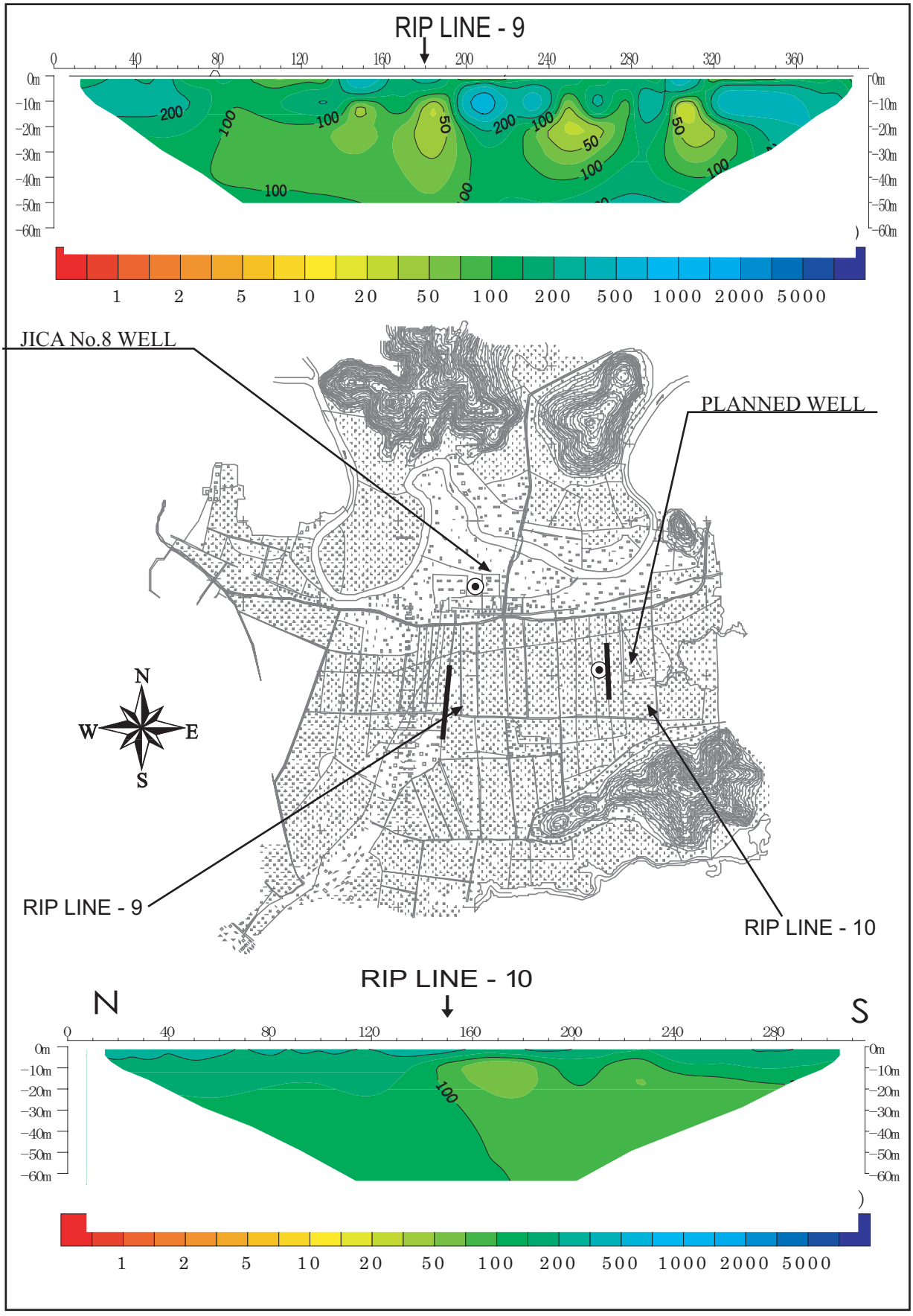
Location of Resistivity Image Profile on Line - 6
in Quang Son Commune, Ninh Binh Province



Location of Resistivity Image Profile on Line - 7
in Yen Thang Commune, Ninh Binh Province



Location of Resistivity Image Profile Line - 8
in Vinh Thanh Commune, Thanh Hoa Province



Location of Resistivity Image Profile Line - 9 & 10
in Van Thang Commune, Thanh Hoa Province

[Appendix – 11] Willingness Survey to All Households

(1) General

It has been found that water supply facilities with house connection system is required by households in all communes. Further, affordability of payment for the house connection and monthly water charge to be paid by users has been surveyed based on the workshops and interview surveys. In the workshop attended by representatives of the commune, the affordability to pay was surveyed, and interview survey was carried out to several households to confirm the results obtained at the workshop. The result of the figures obtained from the process is considered reasonable. Although there are differences among the communes, the affordable house-connection fee is about 300,000 - 600,000 VND (average : 370,000 VND) and the affordable water charge is about 15,000 - 35,000 VND/household/month (average : 22,600 VND/household/month) .

It is an important condition to secure the house connection fee and the water charge paid by users for establishing water supply facility implementation plan and operation and management plan. Although the information obtained at workshop and interview survey might be reasonable, number of persons replied was limited. Then, it was decided that further study to obtain the information (affordability to pay for the house connection fee and the water charge) from all households be carried out in order to publicly inform of the water supply project to households and to improve the accuracy of the affordability of payment.

(2) Willingness Survey to All Households

Willingness surveys on water supply service to all households were carried out to ensure the affordable house connection fee and water charge. A format of the willingness survey was used for households to express the application to have house connection for water supply service when distribution pipelines are installed near the households, and the format would be a role of preliminary application for future actual implementation.

The willingness survey formats were sent to all households in communes by circular system, and households who want to receive the service were requested to write a name of the household master, the address, the affordable amount for house connection fee and monthly water charge, and the signature. The purpose of the willingness survey was explained at workshops held in all communes and the willingness survey formats were delivered at workshops to be sent to all households by circular system. They were collected through P-CERWASS and Central CERWASS in October/November 2001.

Affordable house connection fee was selected among three categories of less than 200,000 VND, 200,000 - 500,000 VND and over 500,000 VND; and affordable monthly water charge among three categories of less than 10,000 VND/household/month, 10,000 - 15,000 VND/h/m and over 15,000VND.

(3) Survey Result

1) Application Percentage

Application percentage, that is a rate of household number entered the survey format, scattered from 19 – 98 % by communes, averaging 67%.

Low application percentage communes were No.1: Hoa Thuong in Thai Nguyen Province (19%), No.2 : Dong Bam in Thai Nguyen Province (56%), No.5 : Dong Phong in Ninh Binh Province (55%), No.8 : Vinh Thanh in Thanh Hoa Province (39%) and No.9 : Vinh Loc in Thanh Hoa Province (34%) .

2) Survey Result by Province

In Thai Nguyen Province, the average affordable house connection fee is 266,000 VND and the category of less than 200,000VND is majority, and the average affordable water charge is 11,600 VND/household/month.

In Ning Binh Province, the average affordable house connection fee is 287,000 VND and its distribution is similar to Thai Nguyen Province, and the average affordable water charge is 12,000 VND/household/month.

In Thanh Hoa Province, the average affordable house connection fee is 314,000 VND and the category of 200,000 - 500,000 VND is majority, and the average affordable water charge is 12,200 VND/household/month.

In all 13 communes, affordability to pay for the house connection fee is 298,000 VND on average, and affordability to pay for the monthly water charge is 12,100 VND/household/month on average.

Result of the willingness survey is shown in following Tables and Figure.

3) Affordability to Pay for House Connection Fee

Affordable house connection fee obtained at workshop is 300,000 - 600,000 VND (average : 370,000 VND) and that obtained by the willingness survey is 200,000 - 500,000 VND (average : 300,000 VND) that is less by about 20%. There might be excessive interpretation on households affordability to pay by the attendance at workshops. House connection cost would be expected to be about 300,000 VND, judging from the willingness survey.

4) Affordability to Pay for Water Charge

Affordable water charge obtained at workshop is 15,000 - 35,000 VND/household/ month (average : 22,600 VND/h/m) and that obtained by the willingness survey is 10,500 - 13,600 VND/h/m (average : 12,100 VND/h/m) that is less by about 45%. There might be excessive interpretation on households affordability to pay by the attendance at workshops. It would be possible for households to pay the water charge of about 15,000 VND/household/month estimated in the

project, as this figure is almost equivalent to the figure obtained at the willingness survey.

Table 1 Affordable Water Charge and Water Production Cost by Province

Name of Province	Affordable Water Charge (VND/ house/month)			Water Unit Cost (VND/m3)	Monthly Water Charge Proposed (VND/ house/month)
	Workshop (A)	Willingness Survey (B)	Average (C) =(A+B)/2	(D)	(E)=D x F
Thai Nguyen	22,500	12,000	17,250	1,800	14,400
Ninh Binh	18,125	12,000	15,060	1,100	8,800
Thanh Hoa	26,000	12,100	19,050	1,600	12,800

Note: - Water consumption (F) is estimated as:
(F) = 0.06 m3/d/head x 4.2 persons/house x 30 days = 7.56 m3/month/house → 8.00 m3/month/house
- Affordable Water Charge (C) ＞ Monthly Water Charge Proposed (E)

Table 1 Result of Preliminary Application Form on House Connection Type Water Supply Service

Province / Commune No. & name		No. of total households in communes	No. of households recording in application	Rate of applied households No.	Affordable house connection fee (VND)			Affordable water charge (VND/house/month)		
					(1A)	(1B)	(1C)	(2A)	(2B)	(2C)
		A	B	B/A	<200,000	200,000 – 500,000	>500,000	<10,000	10,000 – 15,000	>15,000
Thai Nguyen										
1	Hoa Thuong	2,415	1,131	47%	83%	17%	0%	23%	66%	11%
2	Dong Bam	1,311	734	56%	97%	2%	1%	65%	19%	16%
3	Thinh Duc	1,547	921	60%	57%	36%	7%	52%	41%	7%
4	Nam Tien	1,500	1,252	84%	38%	60%	2%	28%	56%	17%
Total		6,773	4,038	60%	66%	32%	2%	39%	49%	13%
Ninh Binh										
5	Dong Phong	2,462	1,354	55%	59%	34%	7%	11%	68%	21%
6	Quang Son	1,700	1,597	94%	75%	25%	0%	52%	47%	1%
7	Yen Thang	2,200	1,925	88%	21%	66%	13%	21%	66%	13%
Total		6,362	4,876	77%	49%	44%	7%	28%	60%	11%
Thanh Hoa										
8	Vinh Thanh	1,500	929	62%	5%	90%	4%	9%	37%	54%
9	Vinh Loc	1,275	1,003	79%	12%	61%	27%	13%	51%	36%
10	Dinh Tuong	1,470	1,428	97%	20%	80%	0%	17%	82%	1%
11	Van Ha (Thieu Hung)	1,780	1,737	98%	21%	61%	17%	20%	59%	21%
12	Thieu Do	1,575	1,351	86%	35%	53%	12%	20%	68%	13%
13	Van Thang	1,570	1,301	83%	87%	13%	0%	89%	6%	5%
Total		9,170	7,749	85%	31%	59%	10%	29%	52%	19%
Grand Total		22,305	16,663	75%	45%	48%	7%	31%	54%	15%

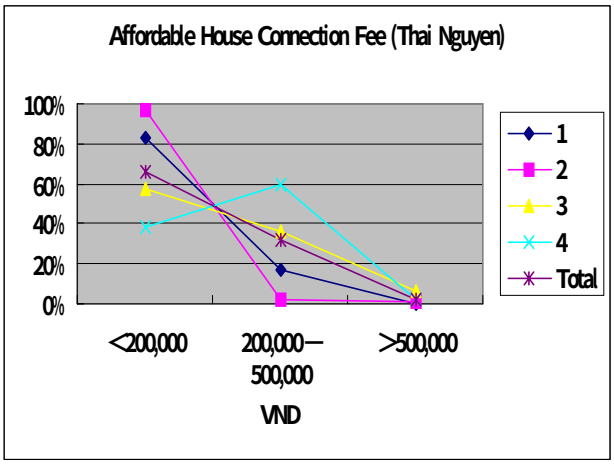
Note: Clarification for only Yen Thang Commune is applied as follows,

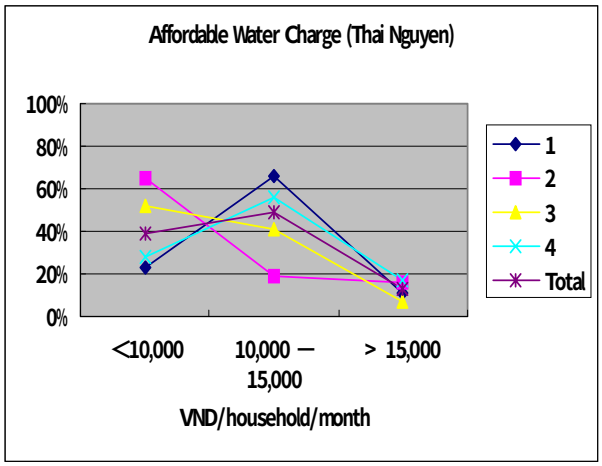
	(1A)	(1B)	(1C)	(2A)	(2B)	(2C)
Clariffication for Yen Thang	300,000	500,000	800,000	5,000	10,000	

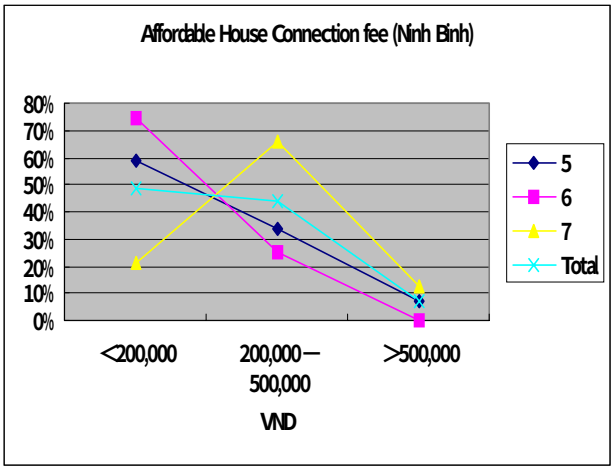
Table 2 Average Affordable Payment on House Connection and Water Charge

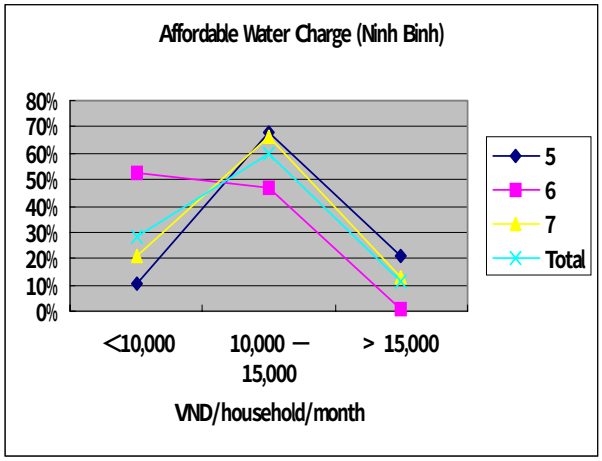
Province Commune No. & name		No. of households	Affordable house connection fee (VND)				Affordable water charge (VND/house/month)			
			(1A)	(1B)	(1C)	Ave	(2A)	(2B)	(2C)	Ave
			<200,000	200,000 – 500,000	>500,000		<10,000	10,000 – 15,000	>15,000	
Thai Nguyen										
1	Hoa Thuong	1,131	83%	17%	0%	224,900	23%	66%	11%	12,200
2	Dong Bam	734	97%	2%	1%	205,500	65%	19%	16%	11,300
3	Thinh Duc	921	57%	36%	7%	273,600	52%	41%	7%	11,400
4	Nam Tien	1,252	38%	60%	2%	296,700	28%	56%	17%	12,200
Total		4,038	66%	32%	2%	254,000	39%	49%	13%	12,000
Ninh Binh										
5	Dong Phong	1,354	59%	34%	7%	272,600	11%	68%	21%	12,800
6	Quang Son	1,597	75%	25%	0%	237,700	52%	47%	1%	11,200
7	Yen Thang	1,925	21%	66%	13%	495,900	21%	66%	13%	10,200
Total		4,876	49%	44%	7%	287,000	28%	60%	11%	12,000
Thanh Hoa										
8	Vinh Thanh	929	5%	90%	4%	348,700	9%	37%	54%	13,600
9	Vinh Loc	1,003	12%	61%	27%	372,300	13%	51%	36%	13,100
10	Dinh Tuong	1,428	20%	80%	0%	319,900	17%	82%	1%	12,100
11	Van Ha (Thieu Hung)	1,737	21%	61%	17%	343,400	20%	59%	21%	12,500
12	Thieu Do	1,351	35%	53%	12%	316,700	20%	68%	13%	12,300
13	Van Thang	1,301	87%	13%	0%	219,900	89%	6%	5%	10,400
Total		7,749	31%	59%	10%	318,500	29%	52%	19%	12,300
Grand Total		16,663	45%	48%	7%	293,000	31%	54%	15%	12,100

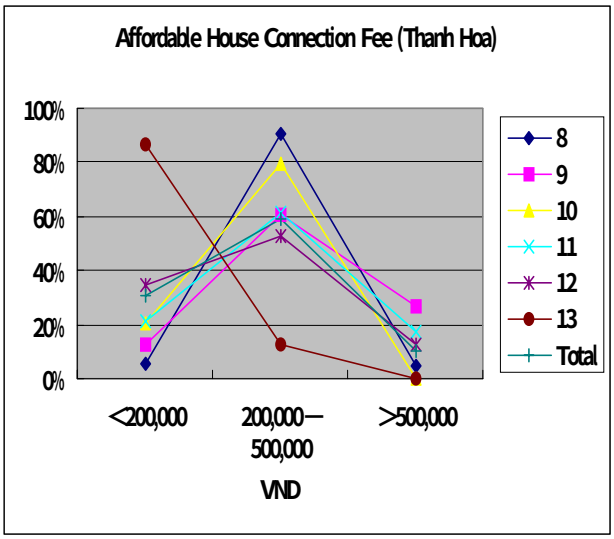
	(1A)	(1B)	(1C)		(2A)	(2B)	(2C)
12Communes	<200,000	200,000 – 500,000	>500,000		<10,000	10,000 – 15,000	> 15,000
Typical value for calculation	200,000	350,000	500,000		10,000	12,500	15,000
Yen Thang	300,000	500,000	800,000		5,000	10,000	20,000











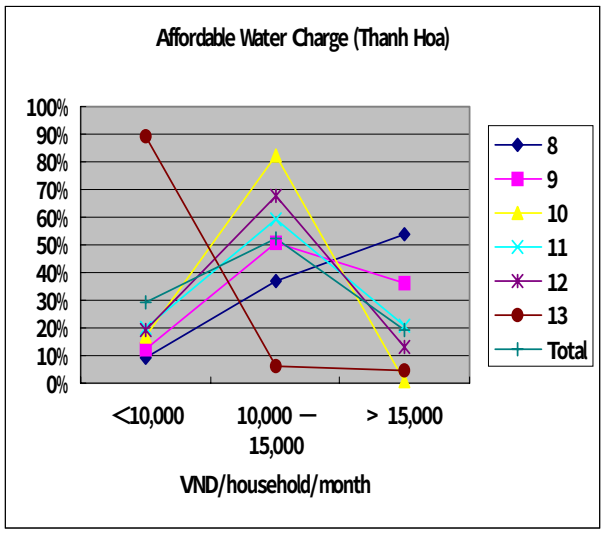


Figure Affordable House Connection Fee and Water Charge

[Appendix – 12] Study on Service Level

The level of service, the system of house connections (HC) or public standpipes (PS) has been studied.

(1) Comparison of Facilities and Costs

Firstly, preliminary designs were made both on HC (House Connection system) and PS (Public Standpipe system). Based on that, facilities and costs for the both were compared between the systems of HC and PS; its result is given in the following table.

Comparison of HC and PS (Facilities and Costs)

Items		PS (Public Standpipes)	HC (House Connections)	Remarks
Comparison	Public standpipe (A) (Mil VND)	583 sites (12,826)	None (0) 0	See a drawing of "Public Standpipe" and "List of Service Pipe's Facilities"
	House connection service pipes (B) (Mil VND)	None (0) 0	18,000 houses (10,800)	
	Branch Tees for house connections (C) (Mil VND)	None (0) 0	18,000 houses (5,226)	
	Block service pipes (D) (Mil VND)	Length = 25,700 m (2,141)	Length = 149,580 m (12,450)	
	Total Cost (Mil VND) (E) = (A+B+C+D)	14,967	28,476	Difference = 13,509
	Vietnamese side' cost in above E (F) (Mil VND)	1,223 (Installation cost for block service pipes)	12,472 (Installation costs for block service pipes and house connections)	Difference = 11,249
	Other major facilities (G)	Almost same HC	Almost same as PS	
Land area for acquisition (H) (Mil VND)		(612 sites : 46,080 m2) 7,373	(29 sites : 16,930 m2) 2,709	See "List of Land Acquisition"
Vietnamese side' costs for pipe installation and land acquisition (J) = F+H (Mil VND)		8,596 By Government : 8,596 By people : 0	15,181 By Government : 9,829 By people : 5,400	Difference = 6,585
Annual maintenance cost (K) (Mil VND)		2,609	2,599	See tables of " Annual Maintenance Costs" and "Staff and Personnel Costs"
Cost of water (L) (VND/m3)		1,463	1,430	See tables of "Water Cost" Estimation"

Note: As for facilities, construction of public standpipes (583 sites in PS system) or house connections (18,000 households in HC system) is a major difference. Further, the total distance of the "block service pipes" is longer in HC system.

(2) Comparison and Consideration

(i) Total cost of facilities' construction is cheaper in PS system than HC system.
(ii) Vietnam side's cost is also cheaper in PS than HC.
(iii) Total area for land acquisition is much larger in PS than HC.
(iv) Total number of land sites for acquisition is extraordinarily larger in PS than HC.
(v) Annual maintenance costs will not differ remarkably between the both systems.
(vi) Water cost per one cubic meter (m3) will also not differ between the both systems.

Comparing with the both systems, there exist advantages and disadvantages respectively in construction and maintenance. However, taking the past experiences for project implementation into consideration, the most important issue is deemed to be "land acquisition" in the stage of construction work. Generally in Vietnam, the procedure for land acquisition is extremely complicated and it usually takes very long time.

Land area required for construction of major facilities of deep wells, treatment plants and reservoirs will take about 16,930 m2 in total of 29 sites, in any system of HC or PS. However, in the case of PS system, additional 583 sites (Area = 29,150 m2 in total) are required for land acquisition. The number of sites for land acquisition in PS system will require 612 sites in total, while HC system need 29 sites only. This must be large remarkable difference between the both systems.

It is considered almost unrealistic and awfully difficult to acquire all lands such as 612 sites in the case of PS systems. On the other hand, HC system require just 29 construction sites, being reasonable and realistic figure. The PS system is judged unrealistic from a viewpoint of land acquisition.

In conclusion, the HC (house connection) system is proposed to be adopted in this project. The HC system has more advantage than the PS system in views of sanitation, living level, water use and people's need, although inferior to little extent in the initial investment costs.

The attached sheets consist of the following items:

(i) Drawing of "Public Standpipe"
(ii) "List of Facilities for Systems of PS and HC"
(iii) "List of Land Acquisition"
(iv) Table of "Estimation of Annual Maintenance Costs for HC System"
(v) Table of "Estimation of Annual Maintenance Costs for PS System"
(vi) Table of "Staff and Personnel Cost for HC System"
(vii) Table of "Staff and Personnel Cost for PS System"

(viii) Table of "Annual Chemical Cost"
(ix) Table of "Annual Electricity Cost"
(x) Table of "Water Tariff Estimation for HC System"
(xi) Table of "Water Tariff Estimation for PS System"

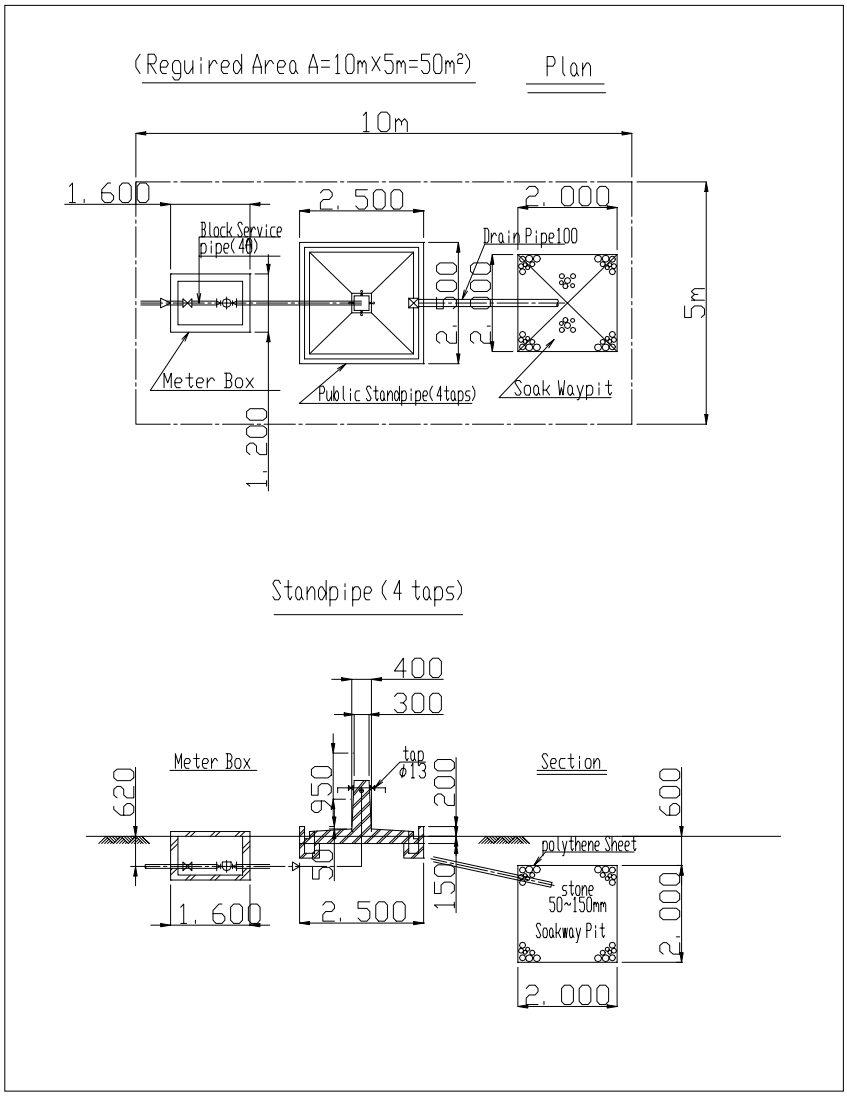
< Supplemental Note >

In the past, the Japan Grant Aid Project for water supply sector was implemented on "the Water Supply System in Gia Lam Area, Hanoi". In this project, the Japanese side's construction work was completed in the scheduled period. However, house connection installation work, the responsibility of the Vietnamese side was much delayed; accordingly the completion of the project has delayed remarkably. Comparing the Gia Lam project with the current project (Rural Part of Northern Provinces), their differences are summarized in the following table; and the current project is considered to overcome such difficulties occurred in the Gia Lam project, according to reasons given in the table.

Comparison with Gia Lam Area (Hanoi) Water Supply Project

Factor of Delay	Reason of Delay of House Connection Construction in Gia Lam Area Water Supply Project	Difference and Countermeasures to be Taken by the Project for the Groundwater Development in Rural Part of Northern Provinces
(1) Responsibility of distribution pipelines' construction	Construction of distribution pipelines was the responsibility of the Vietnam side; its delay caused the delay of house connection installation.	Distribution pipelines are to be constructed by the Japan Grant Aid.
(2) Existing public water supply system	There was an existing public water supply system in a part of the service area.	There does not exist any public water supply system.
(3) Uneven-payment for house connection cost	Some uneven payment happened in the early period.	House connection cost is to be even in the Province.
(4) Need of people	Number of willingness-to-connect was fewer than expected.	Peoples' need is very high.

(i) Public Standpipe



(ii) List of Facilities for Systems of PS and HC

Commune	Public Standpipe (PS) System		House Connection (HC) System	
	Public Standpipe (Nos.)	Length of Block Service Pipe (m)	Number of House Connections (Houses)	Length of Block Service Pipes (m)
No.1 Hoa Thuong	77	4,600	1,850	22,760
No.2 Dong Bam	60	2,700	1,440	16,280
No.3 Thinh Duc	34	1,700	830	8,100
No.4 Nam Tien	45	1,500	1,080	15,340
Thai Nguyen Province (Nos.1,2,3 and 4)	216	10,500	5,200	62,480
No.5 Dong Phong	75	5,150	2,360	16,770
No.6 Quang Son	45	1,750	1,220	11,260
No.7 Yen Thang	58	3,000	2,100	12,020
Ninh Binh Province (Nos.5,6 and 7)	178	9,900	5,680	40,050
Nos. 8 & 9 Vinh Thang & Vinh Loc	64	1,650	3,100	15,970
No.10 Dinh Tuong	46	1,500	1,520	11,850
No.11 Van Ha (Thieu Hung)	55	1,600	1,730	13,200
No.13 Van Thang	24	550	770	6,030
Thanh Hoa Province (Nos.8&9,10,11 and 13)	189	5,300	7,120	47,0500
Total (3 Provinces)	sites 583	m 25,700	houses 18,000	m 149,580

Note: Block Service Pipes: Polyethylene (PE) Pipe, OD = 40 mm, ID = 32.6 mm

(iii) List of Land Acquisition

Commune	Treatment Facilities	Lands to be both systems of HC and PC				Additional Land for PS system
		Treatment Plant	Reservoir	Well Isolated	Total (A)	Standpipe Site (B)
No.1 Hoa Thuong	yes	45m x 38m 1,710 m2		10m x 10m x 1 site 100 m2	2 sites 1,810 m2	50 m2 x 77 sites 3,850 m2
No.2 Dong Bam	no	40m x 35m 1,400 m2	10m x 10m 100 m2 For elevated tank	10m x 10m x 1 site 100 m2	3 sites 1,600 m2	50 m2 x 60 sites 3,000 m2
No.3 (North)	no		25m x 28m 700 m2	10m x 10m x 1 site 100 m2	2 sites 800 m2	50 m2 x 34 sites 1,700 m2
Thinh Duc (South)	no		30m x 26m 780 m2	10m x 10m x 2 sites 200 m2	3 sites 980 m2	
No.4 Nam Tien	yes	35m x 30m 1,050 m2		10m x 10m x 5 sites 500 m2	6 sites 1,550 m2	50 m2 x 45 sites 2,250 m2
No.5 Dong Phong	no		40 m x 35 m 1,400 m2		1 site 1,400 m2	50 m2 x 75 sites 3,750 m2
No.6 Quang Son	no		35 m x 35 m 1,225 m2	10m x 10m x 2sites 200 m2	3 sites 1,425 m2	50 m2 x 45 sites 2,250 m2
No.7 Yen Thang	no		25 m x 25 m 625 m2	10m x 10m x 3 sites 300 m2	4 sites 925 m2	50 m2 x 58 sites 2,900 m2
Nos. 8 & 9 Vinh Thang & Vinh Loc	yes	50m x 38m 1,900 m2			1 site 1,900 m2	50 m2 x 64 sites 3,200 m2
No.10 Dinh Tuong	yes	45m x 35m 1,575 m2			1 site 1,575 m2	50 m2 x 46 sites 2,300 m2
No.11 Van Ha (Thieu Hung)	yes	45m x 38m 1,710 m2			1 site 1,710 m2	50 m2 x 55 sites 2,750 m2
No.13 Van Thang	no		35 m x 33 m 1,155 m2	10m x 10m x 1 site 100 m2	2 sites 1,255 m2	50 m2 x 24 sites 1,200 m2
Total		9,345 m2 6 sies	5,985 m2 7 sies	1,600 m2 16 sies	16,930 m2 29 sies	29,150 m2 583 sies

Note: - Land area for HC system = (A) = 16,930 m2 (29 sites in total)

- Land area for PS system = (A) + (B) = 46,080 m2 (612sites in total)

(iv) Estimation of Annual Maintenance Costs for HC System

No.	Commune	Annual Maintenance Cost (unit: 1,000 VND)					
		Personnel Cost (A)	Chemical Cost (B)	Electricity Cost (C)	Repair Cost (D)	Others (A+B+C) x 5%	Total
Province	of Thani Nguyen						
No.1	Hoa Thuong	69,600	17,666	52,506	79,652	10,971	230,395
No.2	Dong Bam	64,800	13,740	68,219	68,279	10,752	225,790
No.3	Thinh Duc	43,200	1,334	35,464	51,465	6,573	138,036
No.4	Nam Tien	64,800	8,501	45,738	80,758	9,990	209,787
P-CERWASS of Thai Nguyen		98,400				4,920	103,320
	Sub-total	340,800	41,241	201,927	280,153	43,206	907,327
Province	of Ninh Binh						
No.5	Dong Phong	57,600	14,240	56,849	48,117	8,840	185,646
No.6	Quang Son	48,000	7,818	61,410	51,748	8,449	177,425
No.7	Yen Thang	57,600	3,320	51,560	51,097	8,179	171,756
P-CERWASS of Ninh Binh		79,200				3,960	83,160
	Sub-total	242,400	25,378	169,819	150,961	29,428	617,986
Province	of Thanh Hoa						
Nos.8&9	Vinh Thang & Vinh Loc	84,000	24,210	119,958	94,424	16,130	338,722
No.10	Dinh Tuong	69,600	60,101	37,147	72,043	11,945	250,836
No.11	Van Ha (Thieu Hung)	69,600	40,300	61,333	67,718	11,948	250,899
No.13	Van Thang	43,200	6,453	46,531	37,308	6,675	140,167
P-CERWASS of Thanh Hoa		98,400				4,920	103,320
	Sub-total	364,800	131,064	264,969	271,493	51,618	1,083,944
	Total of 3 provinces	948,000	197,683	636,715	702,607	124,252	2,609,257
		36.3%	7.6%	24.4%	26.9%	4.8%	100.0%

Note: 1 Yen = 119 VND, 1 VND = 0.0084 Yen

(v) Estimation of Annual Maintenance Costs for PS System

No.	Commune	Annual Maintenance Cost (unit: 1,000 VND)					
		Personnel Cost (A)	Chemical Cost (B)	Electricity Cost (C)	Repair Cost (D)	Others (A+B+C) x 5%	Total
Province	of Thani Nguyen						
No.1	Hoa Thuong	69,600	17,666	52,506	79,652	10,971	230,395
No.2	Dong Bam	69,600	13,740	68,219	68,279	10,992	230,830
No.3	Thinh Duc	48,000	1,334	35,464	51,465	6,813	143,076
No.4	Nam Tien	64,800	8,501	45,738	80,758	9,990	209,787
P-CERWASS of Thai Nguyen		98,400				4,920	103,320
	Sub-total	350,400	41,241	201,927	280,153	43,686	917,407
Province	of Ninh Binh						
No.5	Dong Phong	57,600	14,240	56,849	48,117	8,840	185,646
No.6	Quang Son	48,000	7,818	61,410	51,748	8,449	177,425
No.7	Yen Thang	57,600	3,320	51,560	51,097	8,179	171,756
P-CERWASS of Ninh Binh		79,200				3,960	83,160
	Sub-total	242,400	25,378	169,819	150,961	29,428	617,986
Province	of Thanh Hoa						
Nos.8&9	Vinh Thang & Vinh Loc	79,200	24,210	119,958	94,424	15,890	333,682
No.10	Dinh Tuong	69,600	60,101	37,147	72,043	11,945	250,836
No.11	Van Ha (Thieu Hung)	69,600	40,300	61,333	67,718	11,948	250,899
No.13	Van Thang	48,000	6,453	46,531	37,308	6,915	145,207
P-CERWASS of Thanh Hoa		98,400				4,920	103,320
	Sub-total	364,800	131,064	264,969	271,493	51,618	1,083,944
	Total of 3 provinces	957,600	197,683	636,715	702,607	124,732	2,619,337
		36.6%	7.5%	24.3%	26.8%	4.8%	100.0%

Note: 1 Yen = 119 VND, 1 VND = 0.0084 Yen

(vi) Staff and Personnel Cost for HC System

Province	No.	Commune	Water treat-ment plant	Popula-tion served (2005) (people)	Houses served (2005) (household)	Number of Staff (persons)									Monthly Unit Cost (VN Dong/month)			Monthly Personnel Cost (VN Dong/month)			Monthly total cost personnel (1,000 VND /month)	Annual total cost personnel (1,000 VND /year)
						Main office					Branch office			Total of Main & Branch (persons)	Director	Sub-total of except Director	Operator	Billing	Director	Sub-total of except Director	Operator	Billing		
						Director	Operation section	Technical section Section	Repair, water quality	Account section	Admi. section	Sub-total of except Director	Operator	Billing	Sub-total of Branch									
Thai Nguyen						1	2	4	1	1	1	9			0	10	1,000,000	800,000			1,000,000	7,200,000	0	0	8,200	98,400
	1	Hoa Thuong	yes	7,760	1,850								6	4	10	10			700,000	400,000		0	4,200,000	1,600,000	5,800	69,600
	2	Dong Bam	yes	6,020	1,440								6	3	9	9			700,000	400,000		0	4,200,000	1,200,000	5,400	64,800
	3	Thinh Duc	no	3,457	830								4	2	6	6			700,000	400,000		0	2,800,000	800,000	3,600	43,200
	4	Nam Tien	yes	4,518	1,080								6	3	9	9			700,000	400,000		0	4,200,000	1,200,000	5,400	64,800
	Sub-total			21,755	5,200	1	2	4	1	1	1	9	22	12	34	44					1,000,000	7,200,000	15,400,000	4,800,000	28,400	340,800
Ninh Binh						1	2	2	1	1	1	7			0	8	1,000,000	800,000			1,000,000	5,600,000	0	0	6,600	79,200
	5	Dong Phong	no	9,890	2,360								4	5	9	9			700,000	400,000		0	2,800,000	2,000,000	4,800	57,600
	6	Quang Son	no	5,090	1,220								4	3	7	7			700,000	400,000		0	2,800,000	1,200,000	4,000	48,000
	7	Yen Thang	no	8,790	2,100								4	5	9	9			700,000	400,000		0	2,800,000	2,000,000	4,800	57,600
	Sub-total			23,770	5,680	1	2	2	1	1	1	7	12	13	25	33					1,000,000	5,600,000	8,400,000	5,200,000	20,200	242,400
Thanh Hoa						1	2	4	1	1	1	9			0	10	1,000,000	800,000			1,000,000	7,200,000	0	0	8,200	98,400
	8, 9	Vinh Thanh & Vinh Loc	yes	13,000	3,100								6	7	13	13			700,000	400,000		0	4,200,000	2,800,000	7,000	84,000
	10	Dinh Tuong	yes	6,360	1,520								6	4	10	10			700,000	400,000		0	4,200,000	1,600,000	5,800	69,600
	11	Van Ha (Thieu Hung)	yes	7,272	1,730								6	4	10	10			700,000	400,000		0	4,200,000	1,600,000	5,800	69,600
	13	Van Thang	no	3,230	770								4	2	6	6			700,000	400,000		0	2,800,000	800,000	3,600	43,200
	Sub-total			29,862	7,120	1	2	4	1	1	1	9	22	17	39	49					1,000,000	7,200,000	15,400,000	6,800,000	30,400	364,800
Total of 3 provinces				75,387	18,000	3	6	10	3	3	3	25	56	42	98	126					3,000,000	20,000,000	39,200,000	16,800,000	79,000	948,000

Basis of estimating collector

The work is reading water meter and water charge collection

Duration for one (1) household	20	min
Working hours a day	8	hour
Number of households surveyed a day	24	households/day
Number of working day a month	20	day
Number of households surveyed a month	480	households/month
Number of households surveyed per two months	960	households/month

(vii) Staff and Personnel Cost for PS System

Province	No.	Commune	Water treat-ment facilities	Popula-tion served (2005) (people)	Houses served (2005) (household)	Number of Staff (persons)												Monthly Unit Cost (VN Dong/month)					Monthly Personnel Cost (VN Dong/month)					Monthly total cost personnel (1,000 VND /month)	Annual total cost personnel (1,000 VND /year)
						Main office							Branch office				Total of Main & Branch (persons)	Director	Sub-total of except Director	Operator	Stand-pipe staff	Billing	Director	Sub-total of except Director	Operator	Stand-pipe staff	Billing		
						Director	Operation section	Technical section Section	Repair, water quality	Account section	Admi. section	Sub-total of except Director	Operator	Stand-pipe staff	Billing	Sub-total of Branch													
Thai Nguyen						1	2	4	1	1	1	9				0	10	1,000,000	800,000				1,000,000	7,200,000	0	0	0	8,200	98,400
	1	Hoa Thuong	yes	7,760	1,850								6	1	3	10	10			700,000	400,000	400,000	0	0	4,200,000	400,000	1,200,000	5,800	69,600
	2	Dong Bam	yes	6,020	1,440								6	1	3	10	10			700,000	400,000	400,000	0	0	4,200,000	400,000	1,200,000	5,800	69,600
	3	Thinh Duc	no	3,457	830								4	1	2	7	7			700,000	400,000	400,000	0	0	2,800,000	400,000	800,000	4,000	48,000
	4	Nam Tien	yes	4,518	1,080								6	1	2	9	9			700,000	400,000	400,000	0	0	4,200,000	400,000	800,000	5,400	64,800
Sub-total				21,755	5,200	1	2	4	1	1	1	9	22	4	10	36	46						1,000,000	7,200,000	15,400,000	1,600,000	4,000,000	29,200	350,400
Ninh Binh						1	2	2	1	1	1	7				0	8	1,000,000	800,000				1,000,000	5,600,000	0	0	0	6,600	79,200
	5	Dong Phong	no	9,890	2,360								4	1	4	9	9			700,000	400,000	400,000	0	0	2,800,000	400,000	1,600,000	4,800	57,600
	6	Quang Son	no	5,090	1,220								4	1	2	7	7			700,000	400,000	400,000	0	0	2,800,000	400,000	800,000	4,000	48,000
	7	Yen Thang	no	8,790	2,100								4	1	4	9	9			700,000	400,000	400,000	0	0	2,800,000	400,000	1,600,000	4,800	57,600
Sub-total				23,770	5,680	1	2	2	1	1	1	7	12	3	10	25	33						1,000,000	5,600,000	8,400,000	1,200,000	4,000,000	20,200	242,400
Thanh Hoa						1	2	4	1	1	1	9				0	10	1,000,000	800,000				1,000,000	7,200,000	0	0	0	8,200	98,400
	8, 9	Vinh Thanh & Vinh Loc	yes	13,000	3,100								6	1	5	12	12			700,000	400,000	400,000	0	0	4,200,000	400,000	2,000,000	6,600	79,200
	10	Dinh Tuong	yes	6,360	1,520								6	1	3	10	10			700,000	400,000	400,000	0	0	4,200,000	400,000	1,200,000	5,800	69,600
	11	Van Ha (Thieu Hung)	yes	7,272	1,730								6	1	3	10	10			700,000	400,000	400,000	0	0	4,200,000	400,000	1,200,000	5,800	69,600
	13	Van Thang	no	3,230	770								4	1	2	7	7			700,000	400,000	400,000	0	0	2,800,000	400,000	800,000	4,000	48,000
Sub-total				29,862	7,120	1	2	4	1	1	1	9	22	4	13	39	49						1,000,000	7,200,000	15,400,000	1,600,000	5,200,000	30,400	364,800
Total of 3 provinces				75,387	18,000	3	6	10	3	3	3	25	56	11	33	100	128						3,000,000	20,000,000	39,200,000	4,400,000	13,200,000	79,800	957,600

Basis of estimating collector

The work is reading water meter and water charge collection

Duration for one (1) household	20	min
Working hours a day	8	hour
Number of households surveyed a day	24	households/day
Number of working day a month	20	day
Number of households surveyed a month	480	households/month
Number of households surveyed per two months	960	households/month

Public stand pipe staff will count meter of public standpipe

(viii) Annual Chemical Cost for Systems of PC and HC

Commune		Sodium Hypochlorite				Aluminum Sulphate				Total Annual Chemical Cost
		Daily Use (kg/day)	Annual Use (kg/year)	Unit Price (VND/kg)	Annual Cost (VND/year)	Daily Use (kg/day)	Annual Use (kg/year)	Unit Price (VND/kg)	Annual Cost (VND/year)	(1,000VND/year)
No.1	Hoa Thuong	40.0	14,600	850	12,410,000	6.0	2,190	2,400	5,256,000	17,666
No.2	Dong Bam	31.3	11,425	850	9,710,825	4.6	1,679	2,400	4,029,600	13,740
No.3	Thinh Duc	4.3	1,570	850	1,334,075				0	1,334
No.4	Nam Tien	17.8	6,497	850	5,522,450	3.4	1,241	2,400	2,978,400	8,501
Thai Nguyen province		93.4	34,091		28,977,350	14.0	5,110		12,264,000	41,241
No.5	Dong Phong	45.9	16,754	850	14,240,475				0	14,240
No.6	Quang Son	25.2	9,198	850	7,818,300				0	7,818
No.7	Yen Thang	10.7	3,906	850	3,319,675				0	3,320
Ninh Binh province		81.8	29,857		25,378,450	0.0	0		0	25,378
Nos. 8&9	Vinh Thang & Vinh Loc	49.8	18,177	850	15,450,450	10.0	3,650	2,400	8,760,000	24,210
No.10	Dinh Tuong	179.6	65,554	850	55,720,900	5.0	1,825	2,400	4,380,000	60,101
No.11	Van Ha (Thieu Hung)	113.8	41,537	850	35,306,450	5.7	2,081	2,400	4,993,200	40,300
No.13	Van Thang	20.8	7,592	850	6,453,200				0	6,453
Thanh Hoa province		364.0	132,860		112,931,000	20.7	7,556		18,133,200	131,064
tal (3 Provinces)		539.2	196,808		167,286,800	34.7	12,666		30,397,200	197,683

(ix) Annual Electricity Cost for Systems of PS and HC

Commune	Treatment Facilities	Electrical Equipment	Flow (m3/day)	Specification		Number in Operation	Operation Hours (hr/day)	Daily Use (kwhr/day)	Unit Price (VND/kwhr)	Total Annual Electricity Cost (1,000VND/year)
	Yes	Intake Pump	597	810m3/d	7.5 kw	1	18.0	135.0	700	34,493
No.1		Distribution Pump	569	1,700m3/d	17.5 kw	1	8.0	60.0	700	15,330
Hoa Thuong		Drain Pump	28	6m3/hr	1.5 kw	1	5.0	7.5	700	1,916
		Miscellaneous			1.5 kw	1	2.0	3.0	700	767
		Sub-total						205.5		52,506
	Yes	Intake Pump	463	630m3/d	11.0 kw	1	18.0	198.0	700	50,589
No.2		Distribution Pump	441	1,320m3/d	7.5 kw	1	8.0	60.0	700	15,330
Dong Bam		Drain Pump	22	6m3/hr	1.5 kw	1	4.0	6.0	700	1,533
		Miscellaneous			1.5 kw	1	2.0	3.0	700	767
		Sub-total						267.0		68,219
	No	Intake Pump	108	150m3/d	2.2 kw	1	18.0	39.6	700	10,118
(North)		Distribution Pump	108	330m3/d	3.7 kw	1	8.0	29.6	700	7,563
		Drain Pump						0.0	700	0
No.3		Miscellaneous			1.0 kw	1	2.0	2.0	700	511
Thinh Duc	No	Intake Pump	145	100m3/d	1.5 kw	2	18.0	36.0	700	9,198
		Distribution Pump	145	440m3/d	3.7 kw	1	8.0	29.6	700	7,563
(South)		Drain Pump						0.0	700	0
		Miscellaneous			1.0 kw	1	2.0	2.0	700	511
		Sub-total						138.8		35,464
	Yes	Intake Pump	350	100m3/d	1.5 kw	5	17.7	132.8	700	33,918
No.4		Distribution Pump	280	100m3/d	2.2 kw	1	16.8	37.0	700	9,443
Nam Tien		Drain Pump	25	900m3/d	1.5 kw	1	4.2	6.3	700	1,610
		Miscellaneous			1.5 kw	1	2.0	3.0	700	767
		Sub-total						179.0		45,738
Thai Nguyen Province										201,927
	No	Intake Pump	726	980m3/d	5.5 kw	1	18.0	99.0	700	25,295
No.5		Distribution Pump	726	2,160m3/d	15.0 kw	1	8.1	121.5	700	31,043
Dong Phong		Drain Pump						0.0	700	0
		Miscellaneous			1.0 kw	1	2.0	2.0	700	511
		Sub-total						222.5		56,849
	No	Intake Pump	392	200m3/d	3.7 kw	3	16.0	177.6	700	45,377
No.6		Distribution Pump	441	1,320m3/d	7.5 kw	1	8.1	60.8	700	15,522
Quang Son		Drain Pump						0.0	700	0
		Miscellaneous			1.0 kw	1	2.0	2.0	700	511
		Sub-total						240.4		61,410
	No	Intake Pump	644	300m3/d	3.7 kw	3	18.0	199.8	700	51,049
No.7		Distribution Pump						0.0	700	0
Yen Thang		Drain Pump						0.0	700	0
		Miscellaneous			1.0 kw	1	2.0	2.0	700	511
		Sub-total						201.8		51,560
Ninh Binh Province										169,819
	Yes	Intake Pump	1,001	1,350m3/d	18.5 kw	1	18.0	333.0	700	85,082
No.8&9		Distribution Pump	953	2,840m3/d	15.0 kw	1	8.1	121.5	700	31,043
Vinh Thang &		Drain Pump	48	6m3/hr	1.5 kw	1	8.0	12.0	700	3,066
Vinh Loc		Miscellaneous			1.5 kw	1	2.0	3.0	700	767
		Sub-total						469.5		119,958
	Yes	Intake Pump	490	630m3/d	3.7 kw	1	18.7	69.2	700	17,678
No.10		Distribution Pump	467	1,260m3/d	7.5 kw	1	9.0	67.5	700	17,246
Dinh Tuong		Drain Pump	23	6m3/hr	1.5 kw	1	3.8	5.7	700	1,456
		Miscellaneous			1.5 kw	1	2.0	3.0	700	767
		Sub-total						145.4		37,147
	Yes	Intake Pump	560	720m3/d	7.5 kw	1	17.8	133.5	700	34,109
No.11		Distribution Pump	533	1,440m3/d	11.0 kw	1	8.8	96.8	700	24,732
Van Ha		Drain Pump	27	6m3/hr	1.5 kw	1	4.5	6.8	700	1,725
(Thieu Hung)		Miscellaneous			1.5 kw	1	2.0	3.0	700	767
		Sub-total						240.1		61,333
	No	Intake Pump	249	170m3/d	3.7 kw	2	17.8	131.7	700	33,654
No.13		Distribution Pump	237	710m	5.5 kw	1	8.8	48.4	700	12,366
Van Thang		Drain Pump						0.0	700	0
		Miscellaneous			1.0 kw	1	2.0	2.0	700	511
		Sub-total						182.1		46,531
Thanh Hoa Province										264,969
Total										636,715

(x) Water Tariff Estimation for HC System

No.	Commune	A Annual Maintenance Cost (1,000VND)	B (Fx365) Annual Water Sold (m3/year)	C (1,000xA/B) Unit Water Cost (VND/m3)	D Service Population (people)	E Service Household (house)	F Daily Average Comsumption (m3/day)
No.1	Hoa Thuong	230,395	186,150	1,238	7,760	1,850	510
No.2	Dong Bam	225,790	146,000	1,547	6,020	1,440	400
No.3	Thinh Duc	138,036	83,950	1,644	3,457	830	230
No.4	Nam Tien	209,787	109,500	1,916	4,518	1,080	300
P-CERWASS of Thai Nguyen		103,320					
	Sub-total of Thai Nguyen	907,327	525,600		21,755	5,200	1,440
	Average of Thai Nguyen Province			1,726			
No.5	Dong Phong	185,646	237,250	782	9,890	2,360	650
No.6	Quang Son	177,425	124,100	1,430	5,090	1,220	340
No.7	Yen Thang	171,756	211,700	811	8,790	2,100	580
P-CERWASS of Ninh Binh		83,160					
	Sub-total of Ninh Binh	617,986	573,050		23,770	5,680	1,570
	Average of Ninh Binh Province			1,078			
Nos.8&9	Vinh Thang & Vinh Loc	338,722	313,900	1,079	13,000	3,100	860
No.10	Dinh Tuong	250,836	153,300	1,636	6,360	1,520	420
No.11	Van Ha (Thieu Hung)	250,899	175,200	1,432	7,272	1,730	480
No.13	Van Thang	140,167	76,650	1,829	3,230	770	210
P-CERWASS of Thanh Hoa		103,320					
	Sub-total of Thanh Hoa	1,083,944	719,050		29,862	7120	1,970
	Average of Thanh Hoa Province			1,507			
	Total / Average (3 Provinces)	2,609,257	1,817,700	1,435	75,387	18,000	4,980

(xi) Water Tariff Estimation for PS System

No.	Commune	A Annual Maintenance Cost (1,000VND)	B (Fx365) Annual Water Sold (m3/year)	C (1,000xA/B) Unit Water Cost (VND/m3)	D Service Population (people)	E Service Household (house)	F Daily Average Comsumption (m3/day)
No.1	Hoa Thuong	230,395	186,150	1,238	7,760	1,850	510
No.2	Dong Bam	230,830	146,000	1,581	6,020	1,440	400
No.3	Thinh Duc	143,076	83,950	1,704	3,457	830	230
No.4	Nam Tien	209,787	109,500	1,916	4,518	1,080	300
P-CERWASS of Thai Nguyen		103,320					
	Sub-total of Thai Nguyen	917,407	525,600		21,755	5,200	1,440
	Average of Thai Nguyen Province			1,745			
No.5	Dong Phong	185,646	237,250	782	9,890	2,360	650
No.6	Quang Son	177,425	124,100	1,430	5,090	1,220	340
No.7	Yen Thang	171,756	211,700	811	8,790	2,100	580
P-CERWASS of Ninh Binh		83,160					
	Sub-total of Ninh Binh	617,986	573,050		23,770	5,680	1,570
	Average of Ninh Binh Province			1,078			
Nos.8&9	Vinh Thang & Vinh Loc	333,682	313,900	1,063	13,000	3,100	860
No.10	Dinh Tuong	250,836	153,300	1,636	6,360	1,520	420
No.11	Van Ha (Thieu Hung)	250,899	175,200	1,432	7,272	1,730	480
No.13	Van Thang	145,207	76,650	1,894	3,230	770	210
P-CERWASS of Thanh Hoa		103,320					
	Sub-total of Thanh Hoa	1,083,944	719,050		29,862	7,120	1,970
	Average of Thanh Hoa Province			1,507			
	Total / Average (3 Provinces)	2,619,337	1,817,700	1,441	75,387	18,000	4,980

[Appendix - 13] List of Data Collected in Vietnam

1) "National Rural Clean Water Supply and Sanitation Strategy up to Year 2020" (August 2000 by Ministry of Construction & Ministry of Agriculture and Rural Development)
2) "Vietnam-UNICEF Cooperation Project, Cycle 2001-2005"
3) "Rural Water Supply Plan in the Year 2001 with UNICEF Support"
4) Topographical map（scale: 1/5,000）13Communes (42 sheets / set)
5) "Vietnam's Economy in 2000" by Central Institute for Economic Management (Statistical Publishing House, Hanoi - 2000)
6) Report on Results of Population Projections in Vietnam, 1999-2024 (Statistical Publishing House)
7) "Statistical Yearbook 2000" by General Statistical Office (Statistical Publishing House)
8) "Socio-Economic Statistical Data of 61 Provinces and Cities" (Statistical Publishing House)
9) "Don Gia Xay Dung Co Ban, Thai Nguyen" (Price data book of Thai Nguyen in 1999)
10) "Don Gia Xay Dung Co Ban, Ninh Binh" (Price data book of Ninh Binh in 1999)
11) "Don Gia Xay Dung Co Ban, Thanh Hoa Ⅰ, Ⅱ" (Price data book of Ninh Binh in 1999: I& II)
12) "The Hydrogeological-Engineering Geological Subdivision No.47" (Outline of organization)
13) "The Hydrogeological-Engineering Geological Subdivision No.54" (Outline of organization)
14) List of Vietnamese Contractors
15) Installation manual for PVC pipe (Tien Phong Plastic Company)
16) Existing deep well data near Hoa Thuong, Dong Bam, Yen Thang & Van Thang