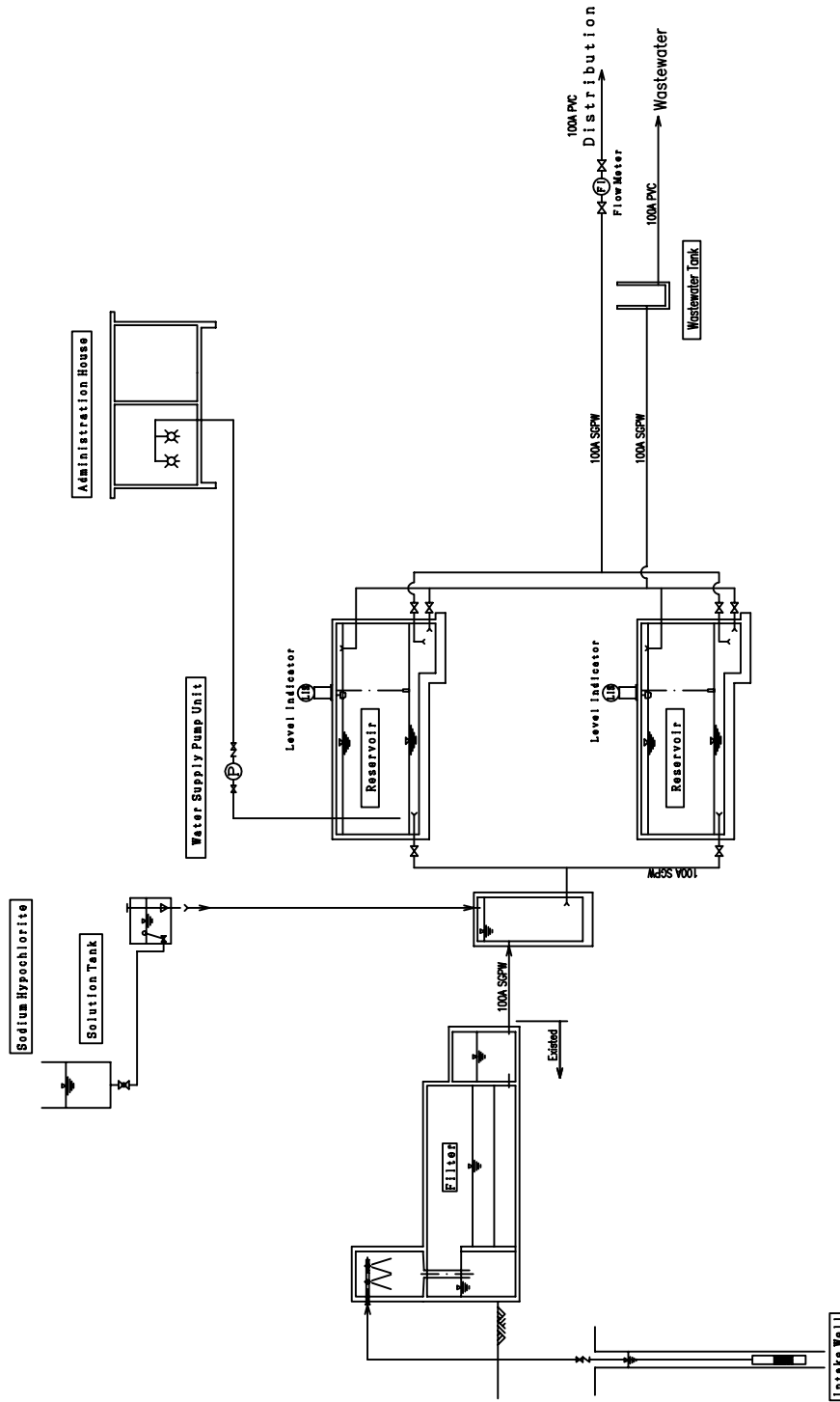


K3-1 Dak Ui



Capacity 259m³/d

Name	J1 Deep Well Pump	Aeration Tower	Sand Filter	Reservoir	Water Supply Pump Unit
Specification	φ50x0.18m ³ /min ³ 79m ³ ×5.5kw	W1.5m×L1.0m× H3.5m	W2.2m×L1.5m A=15.88m ² V=16.5m ³ /d	W3.0m×L1.0m× H3.0m	φ32x0.1m ³ /min ³ 15m ³ ×0.75kw
New	-	1	-	2	1
Existing	1	-	-	-	-
Remarks					

DATE	APPD	REVISION

NOTE

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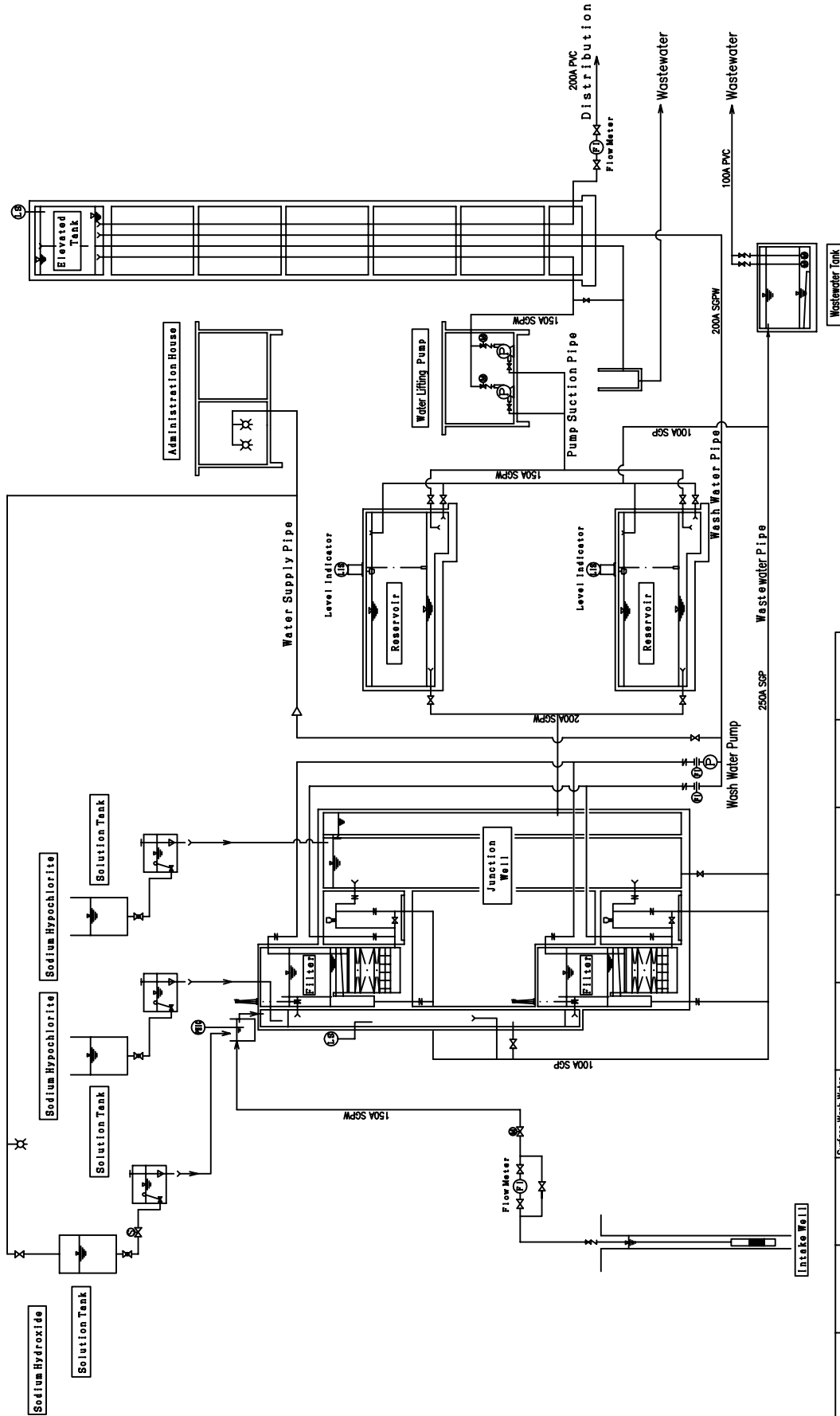
K3-1 Dak Ui Flow Sheet

BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM
IN CENTRAL-HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM

SCALE NONE

APPROVED
CHECKED
DRAWN
DWG. NO.
(6)

G1 Kong Tang



Capacity 636m³/d

Name	J1 Deep Well Pump	N1 Deep Well Pump	Rapid Sand Filter	Surface Wash Water Pump	Reservoir	Water Lifting Pump	Elevated Tank	Drain Pit	Drain Pit Pump
Specification	#50x0.23m ³ /min x 73m x 5.5kw	#50x0.23m ³ /min x 82m x 5.5kw	W1, 4m x L1.5m A=2.66m ² V=120m ³ /d	#800 x 0.4m ³ /min x 17m x 3.7kw	W4, 0m x L9.0m x H3.0m	#100 x 0.88m ³ /min x 15m x 7.5kw	W4, 4m x L4.4m x H2.0m	W3, 0m x L3.0m x H2.0m	#50 x 0.1m ³ /min x 10m x 0.75kw
New	1	1	2	1	2	2	1	1	1
Existing	-	-	-	-	-	-	-	-	-
Remarks									

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G1 Kong Tang Flow Sheet

SCALE: NONE

DWG. NO. (7)

DATE: _____

APPROVED: _____

CHECKED: _____

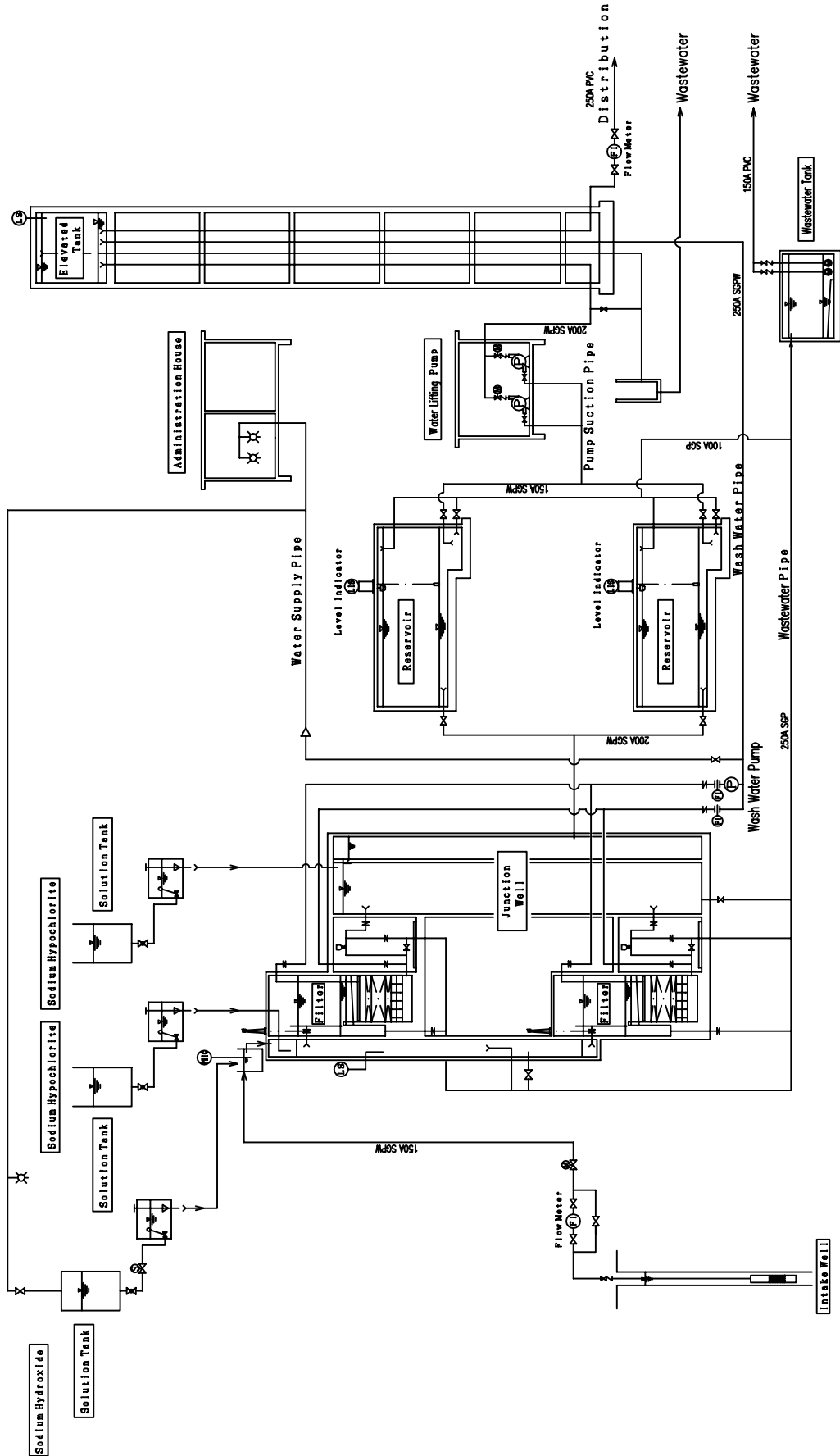
DRAWN: _____

BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM

NOTE:

NO.	DATE	APPD.	REVISION

G2 Nhon Hoa



Capacity 1075m³/d

Name	N1 Deep Well Pump	N2 Deep Well Pump	N3 Deep Well Pump	N4 Deep Well Pump	N5 Deep Well Pump	N6 Deep Well Pump	Rapid Sand Filter	Surface Wash Water Pump	Reservoir	Water Lifting Pump	Elevated Tank	Drain Pit Pump
Specification	40x0.12m ³ /min x 87m x 3.7kw	40x0.12m ³ /min x 88m x 3.7kw	40x0.12m ³ /min x 118m x 5.5kw	40x0.12m ³ /min x 88m x 3.7kw	40x0.12m ³ /min x 85m x 3.7kw	40x0.12m ³ /min x 116m x 5.5kw	W2.0m x L2.3m A=4.8m ² V=120m ³ /d	40x0.69m ³ /min x 17m x 3.7kw	W4.0m x L15.0m x H3.0m	150x1.48m ³ /min x 17m x 11kw	W5.0m x L5.0m x H2.0m	400x0.1m ³ /min x 10m x 0.75kw
New	1	1	1	1	1	1	2	1	2	2	1	1
Existing	-	-	-	-	-	-	-	-	-	-	-	-
Remarks							Mn Sand					

APPROVED _____

CHECKED _____

DRAWN _____

DATE _____

SCALE NONE

DWG. NO. (8)

BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM

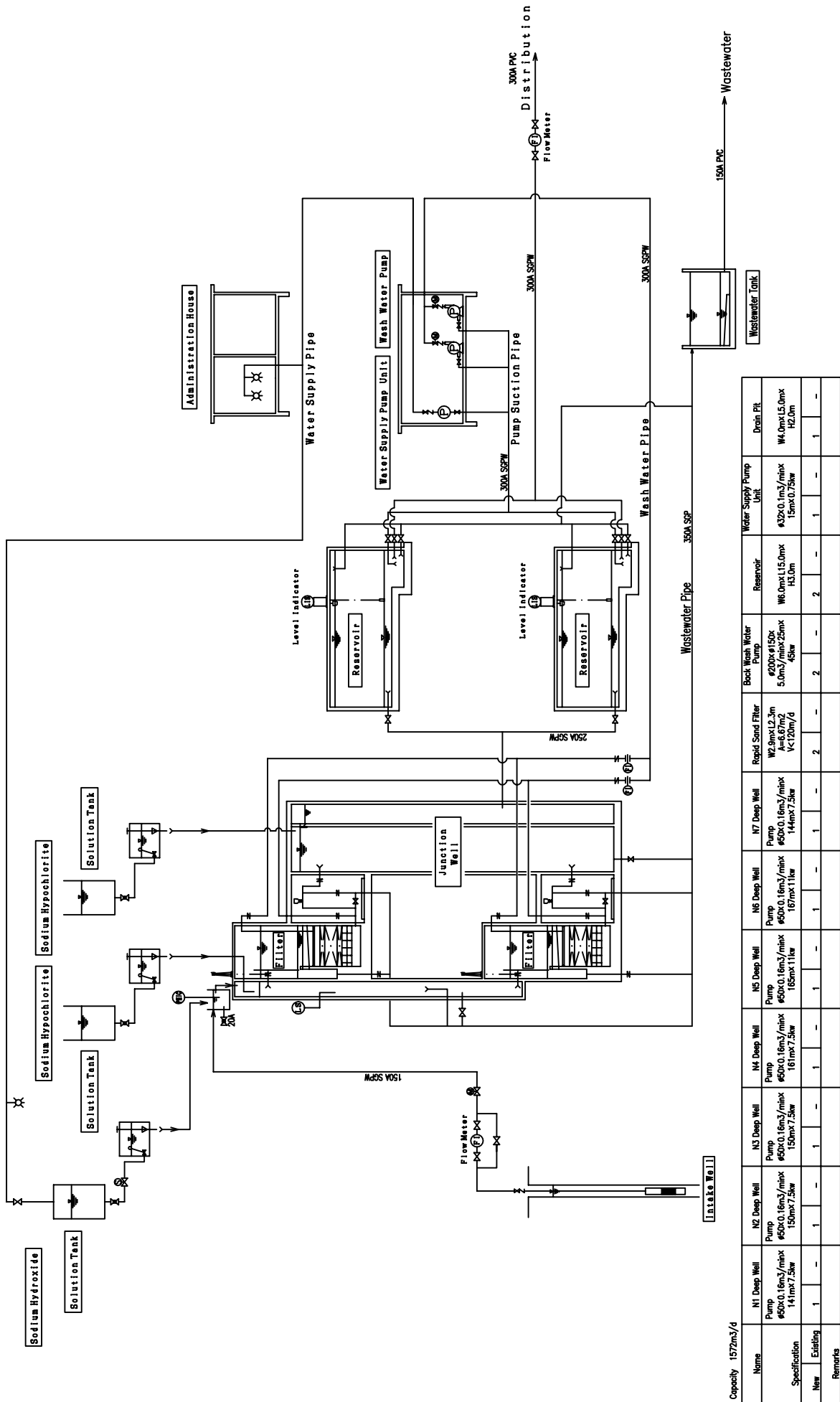
G2 Nhon Hoa Flow Sheet

JAPAN INTERNATIONAL COOPERATION AGENCY

NOTE:

NO.	DATE	APPD.	REVISION

D2 Ea Drang



Capacity 157m³/d

Name	N1 Deep Well Pump	N2 Deep Well Pump	N3 Deep Well Pump	N4 Deep Well Pump	N5 Deep Well Pump	N6 Deep Well Pump	N7 Deep Well Pump	Rapid Sand Filter	Back Wash Water Pump	Reservoir	Water Supply Pump Unit	Drain Pit
Specification	#50x0.16m ³ /minx 141mx7.5kw	#50x0.16m ³ /minx 150mx7.5kw	#50x0.16m ³ /minx 150mx7.5kw	#50x0.16m ³ /minx 161mx7.5kw	#50x0.16m ³ /minx 167mx7.5kw	#50x0.16m ³ /minx 167mx7.5kw	#50x0.16m ³ /minx 144mx7.5kw	W2.9mx4.2.3m A=6.67m ² V=120m ³ /d	#200x#150x 5.0m ³ /minx25m ³ 45kw	W6.0mx11.5.0mx H3.0m	#32x0.1m ³ /minx 15m ³ x0.75kw	W4.0mx1.5.0mx H2.0m
New	1	1	1	1	1	1	1	2	2	2	1	1
Remarks												

JAPAN INTERNATIONAL COOPERATION AGENCY

DATE: _____

CHECKED: _____

DRAWN: _____

SCALE: NONE

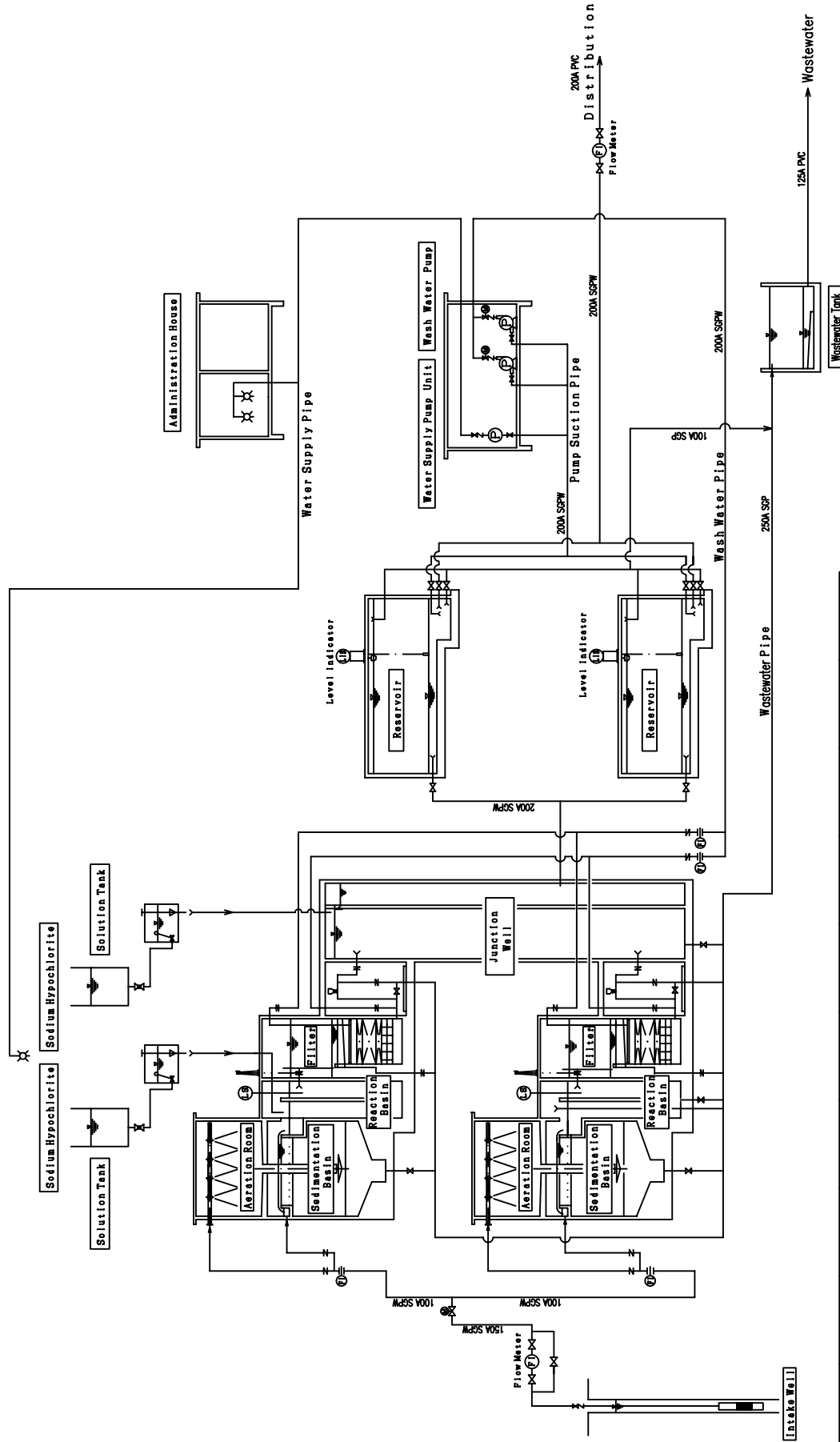
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BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM
IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM

D2 Ea Drang Flow Sheet

REVISION

D4-1 Ea Drong



Capacity 668m³/d

Name	J1 Deep Well Pump	N1 Deep Well Pump	N2 Deep Well Pump	Aeration Room	Sedimentation Basin	Rapid Sand Filter	Back Wash Water Pump	Reservoir	Water Supply Pump Unit	Drain Pit
Specification	#50x0.19m ³ /min ³ 117m ³ /5hr	#50x0.19m ³ /min ³ 112m ³ /7.5hr	#50x0.19m ³ /min ³ 138m ³ /7.5hr	W5.55m x L2.95m x H4.0m	W5.2m x L2.6m x H4.15m	W1.4m x L2.0m A=2.8m ² V<120m ³ /d	#125x#100x 2.1m ³ /min ³ x 25m ³ 15hr	W4.0m x L9.5m x H3.0m	#32x0.1m ³ /min ³ 15m ³ x 0.75hr	W3.0m x L3.5m x H2.0m
New	1	1	1	2	2	2	1	2	2	1
Existing	-	-	-	-	-	-	-	-	-	-
Remarks										

NO.	DATE	APPD.	REVISION

NOTE:

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BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM
IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM

D4-1 Ea Drong Flow Sheet

SCALE: NONE

DATE: _____

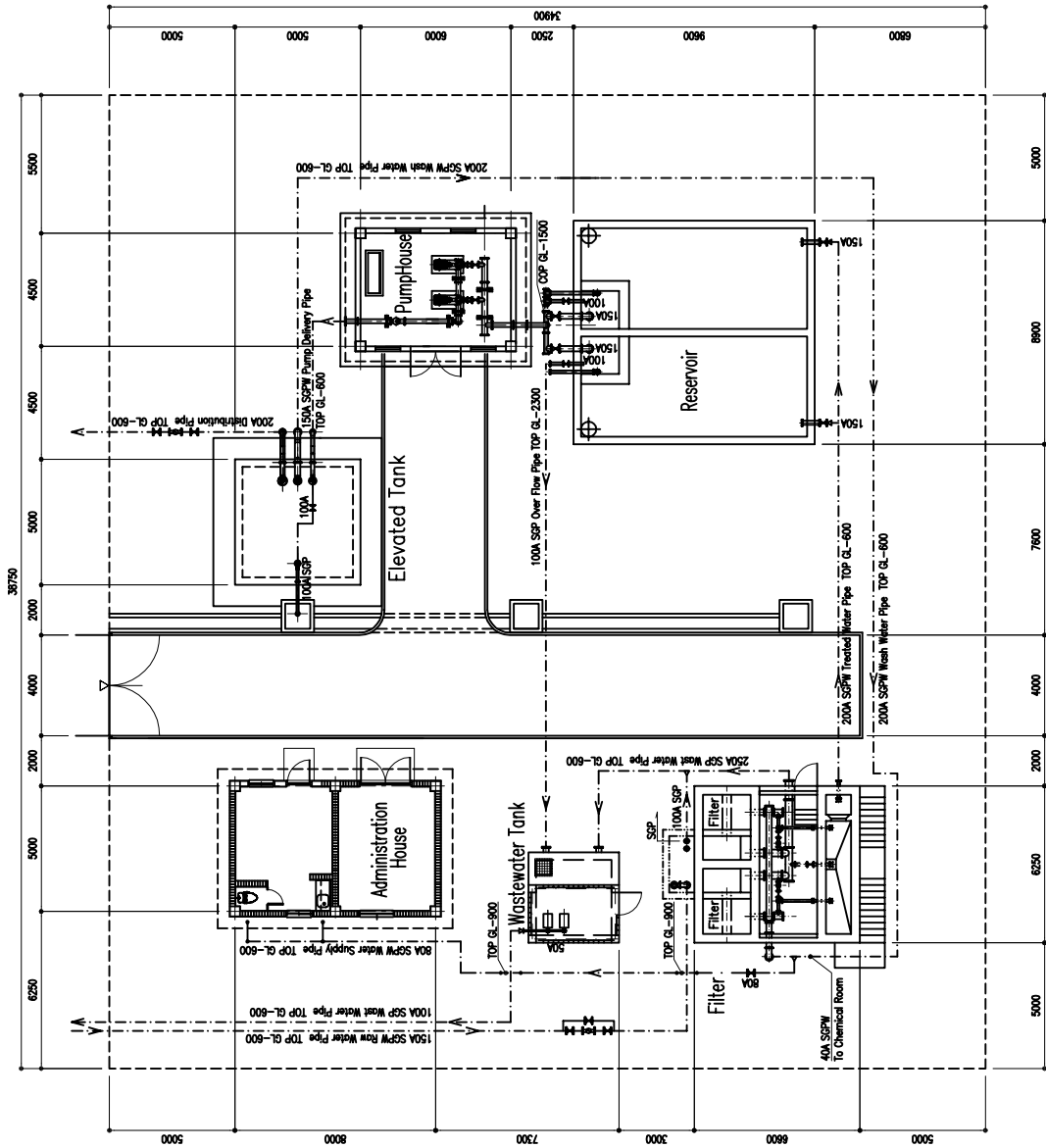
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CHECKED: _____

DRAWN: _____

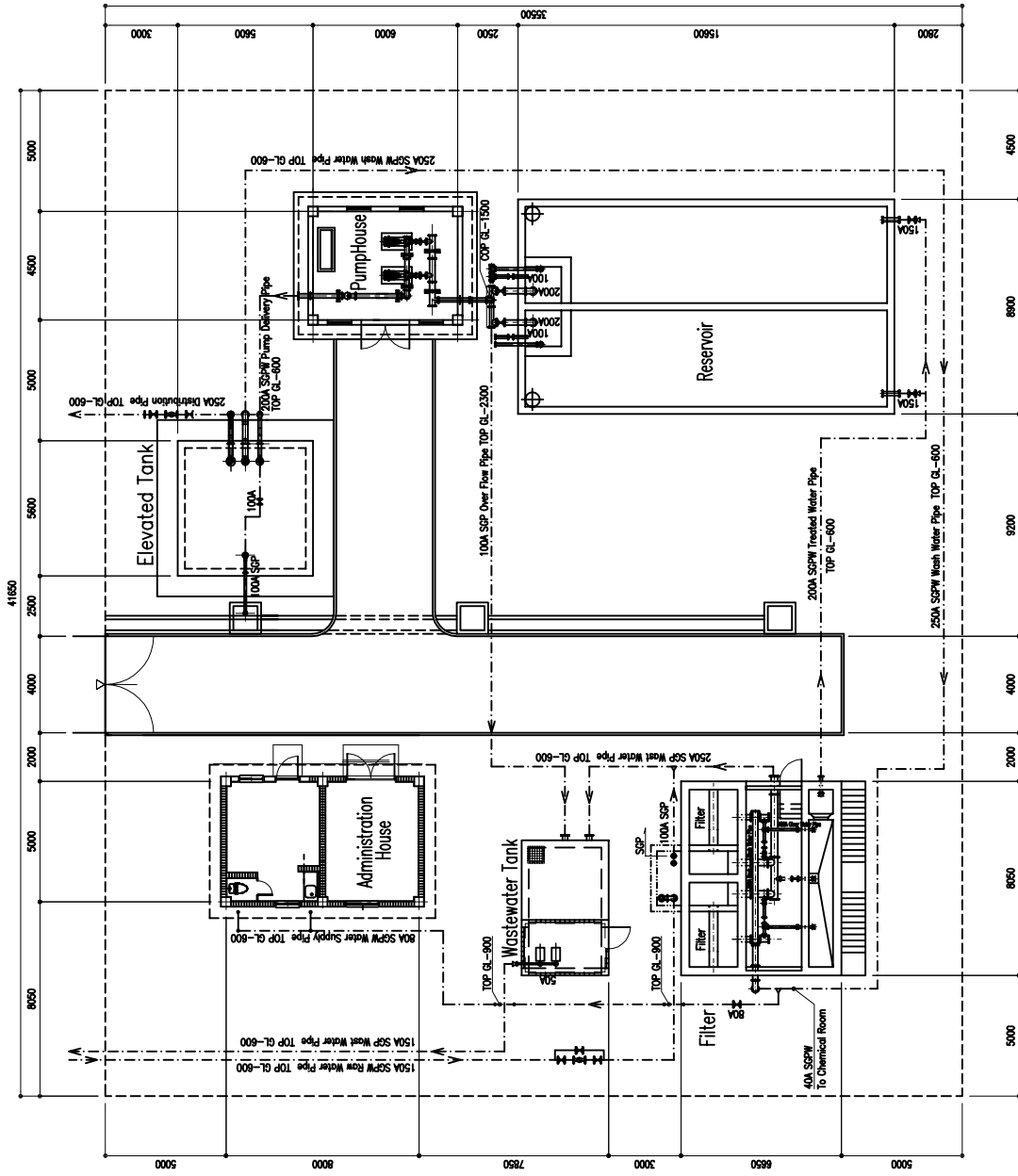
DWG. NO. (10)

G1 Kong Tang



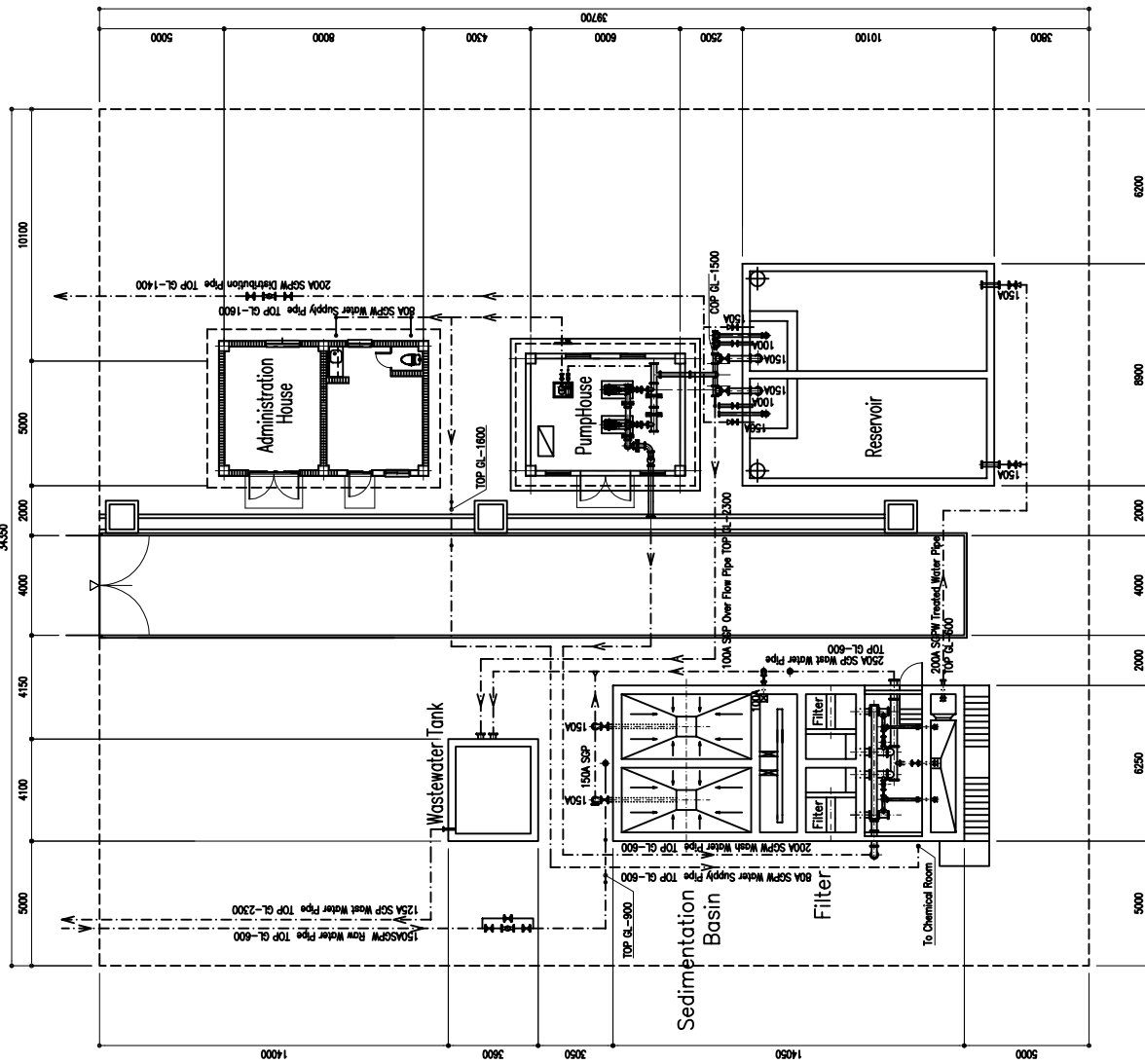
APPROVED		DATE	BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM IN THE SOCIALIST REPUBLIC OF VIETNAM	SCALE	G1 Kong Tang Layout of W/P	DWG. NO. (12)
CHECKED						
DRAWN						
NO.		DATE	APPRO.	REVISION		

G2 Nhon Hoa



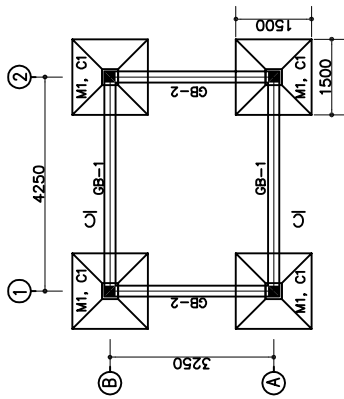
NO.		DATE	APPROVED	G2 Nhon Hoa Layout of WTP	SCALE	DATE	APPROVED	CHECKED	DRAWN	DWS. NO. (13)	
NOTE:				BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM				JICA JAPAN INTERNATIONAL COOPERATION AGENCY			
G2 Nhon Hoa											

D4-1 Ea Drong

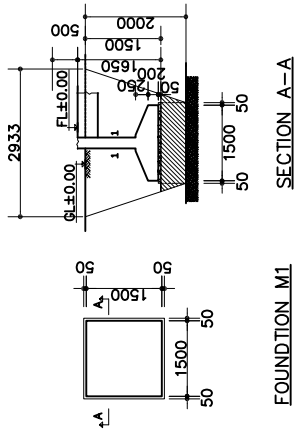


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CHECKED					
DRAWN			D4-1 Ea Drong Layout of WTP		
DATE			JICA JAPAN INTERNATIONAL COOPERATION AGENCY		
NO.			NOTE:		
DATE			REVISION		
APPRO					
NO.					

FOUNDATION FOR WELL PUMP HOUSE



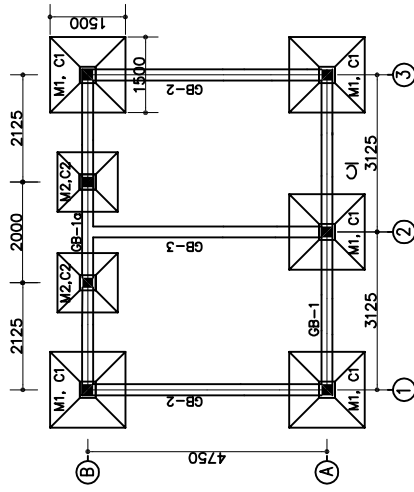
PLAN OF FOUNDATIONS, G— BEAMS AND COLUMNS



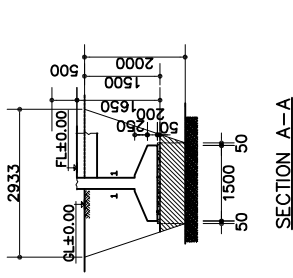
FOUNDATION M1

SECTION A-A

FOUNDATION FOR PUMP HOUSE

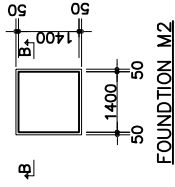


PLAN OF FOUNDATIONS, G— BEAMS AND COLUMNS



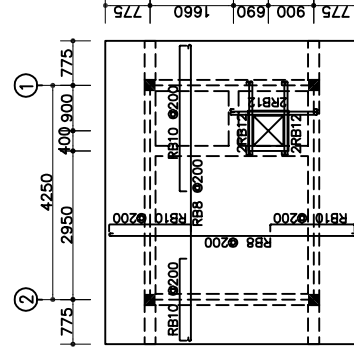
FOUNDATION M1

SECTION A-A

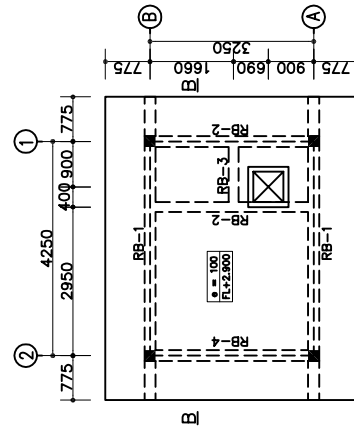


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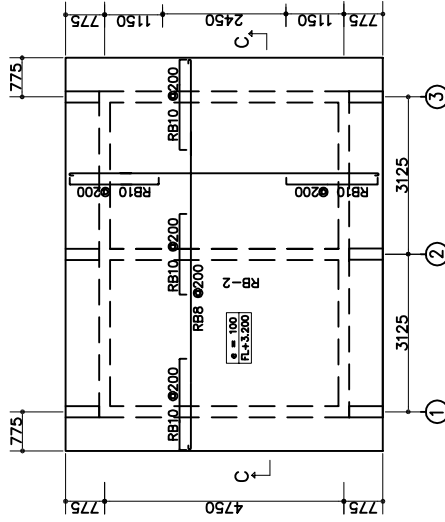
SECTION B-B



REBAR DISTRIBUTION ON ROOF'S SLAB



REBAR DISTRIBUTION ON ROOF'S SLAB



REBAR DISTRIBUTION ON ROOF'S SLAB

NO.	DATE	APP'D	REVISION

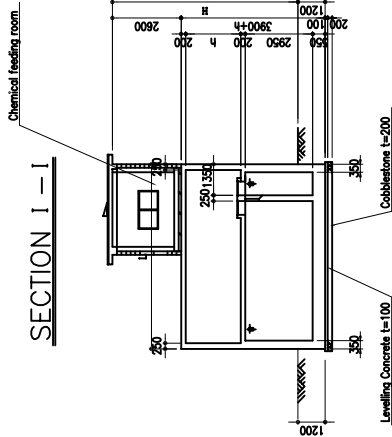
NOTE:

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BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM
IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM
Pump House & Well Pump House(2/2)
(G1 Kong Tang, G2 Nhon Hoa, D2 Ea Drang, D4 Ea Drong)

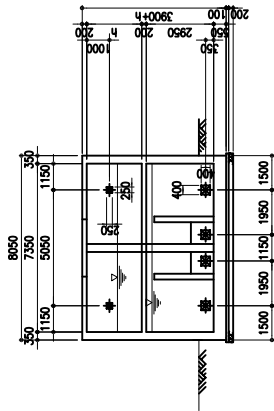
DATE	APPROVED
	CHECKED
	DRAWN
	DWG. NO.
	(1 / 1)

FILTER (Type-2)

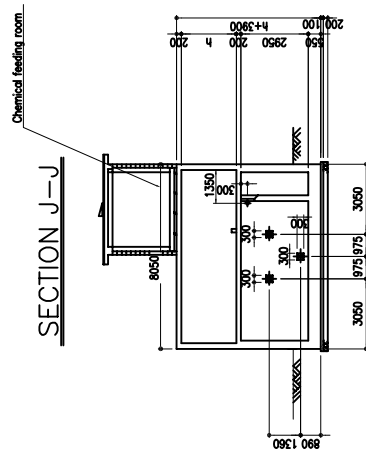
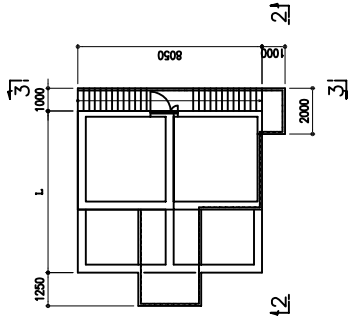


SECTION I-I

SECTION K-K

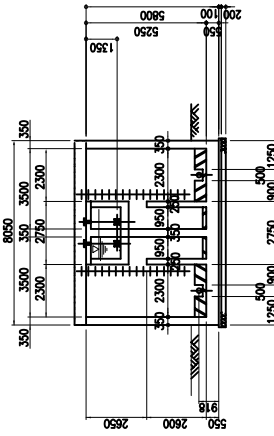


SECTION 1-1

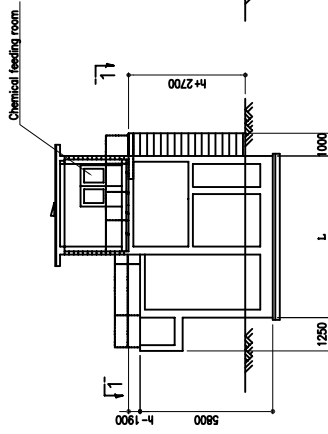


SECTION J-J

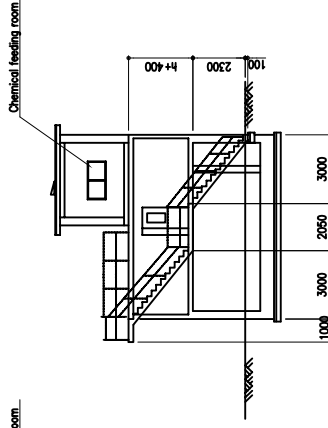
SECTION L-L



SECTION 2-2



SECTION 3-3



Dimension of Facilities

No	Commune	Design capacity (m ³)	Dimension		Remarks	
			W(m)	L(m)		h(m)
G2	Nhon Hoa	1,075	8,050	7,900	3,500	8,800
D2	Ea Drang	1,572	8,050	8,800	3,500	8,800

No	DATE	APPTD	REVISION

NOTE:



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BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM

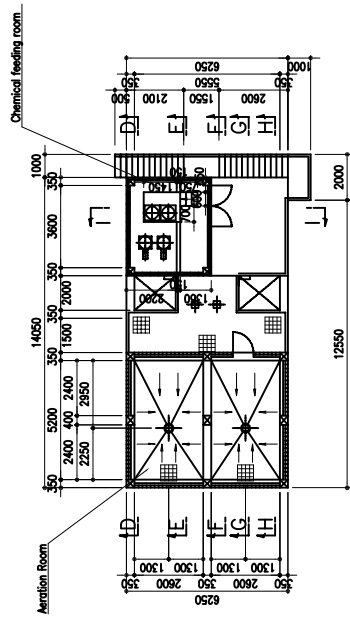
Purification facilities (Type-2: Filter) 2/2 (02 Nhon Hoa, D2 Ea Drang)

DATE	APPROVED

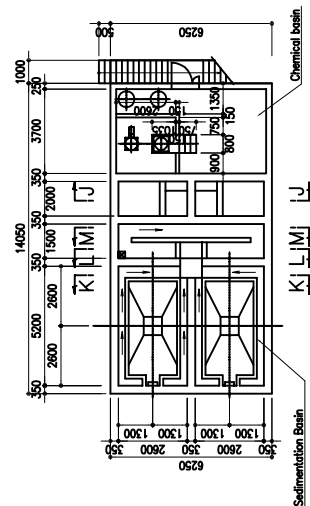
SCALE 1:100
DWG. NO. (21)

AERATION ROOM, SEDIMENTATION BASIN, FILTER

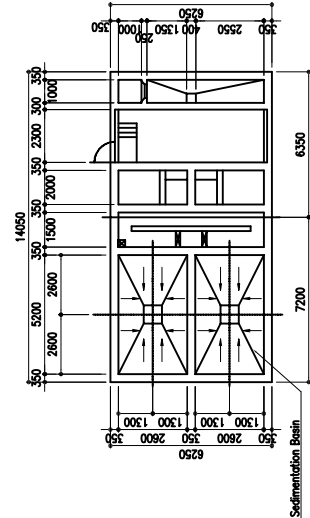
SECTION A-A



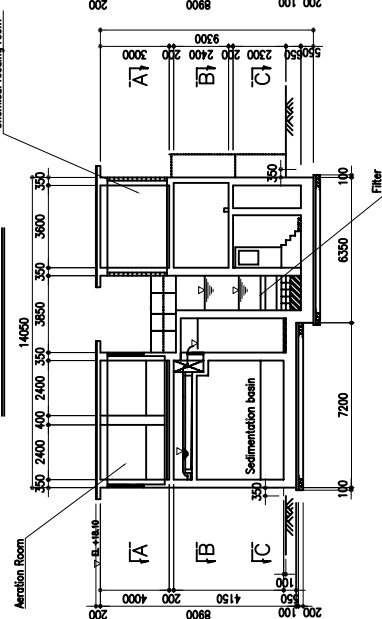
SECTION B-B



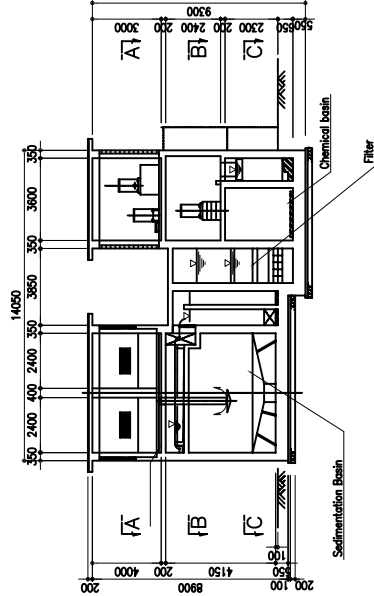
SECTION C-C



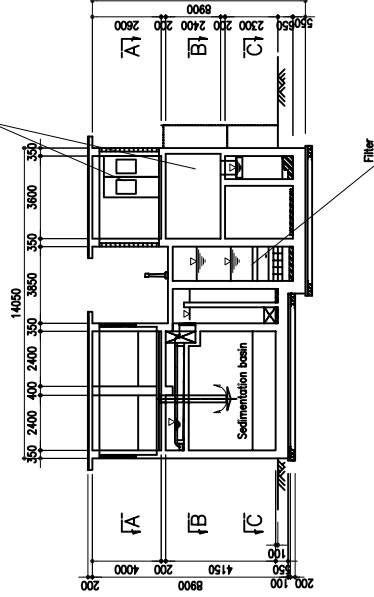
SECTION D-D



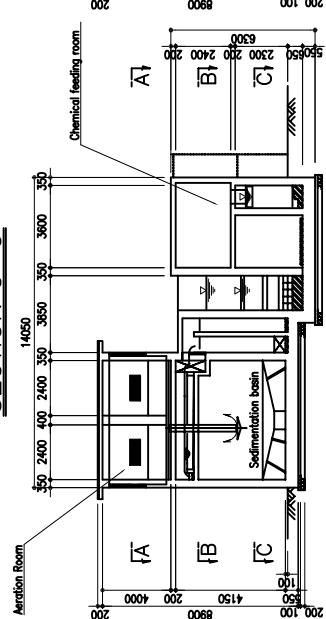
SECTION E-E



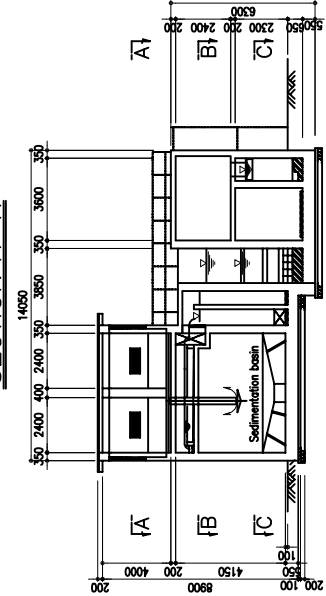
SECTION F-F



SECTION G-G



SECTION H-H



Design Capacity

No	Commune	Design capacity (m ³)	Remarks
D4-1	Ea Drong	668	

No	DATE	APPD	REVISION

NOTE:



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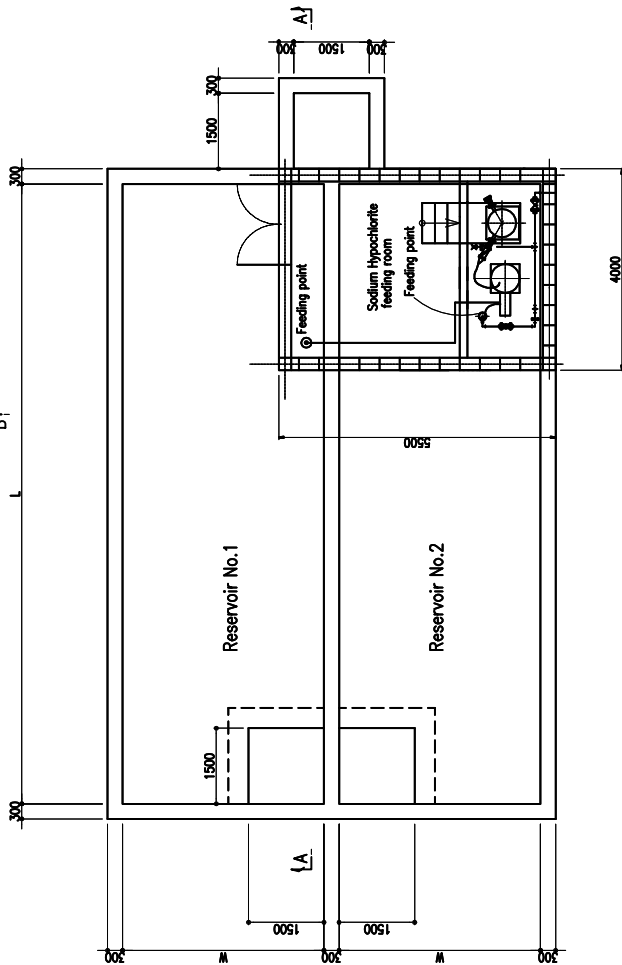
BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM

Purification facilities (Aeration room, Sedimentation basin, Filter)(1/2)
(D4-1 Ea Drong)

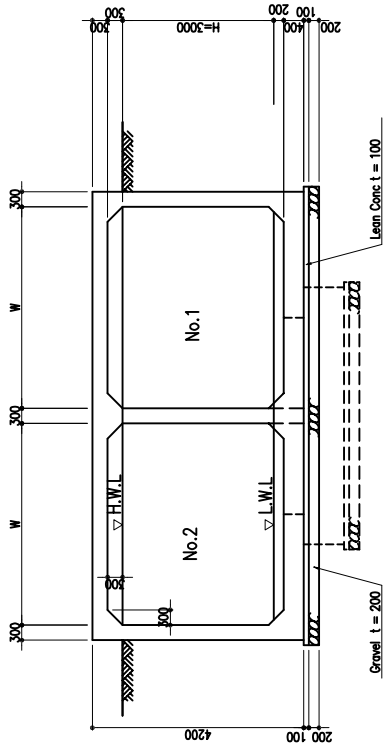
DATE	APPROVED
	CHECKED
	DRAWN
	DWG. NO.
	(22)

RESERVOIR (Type-1)

PLANE B-B

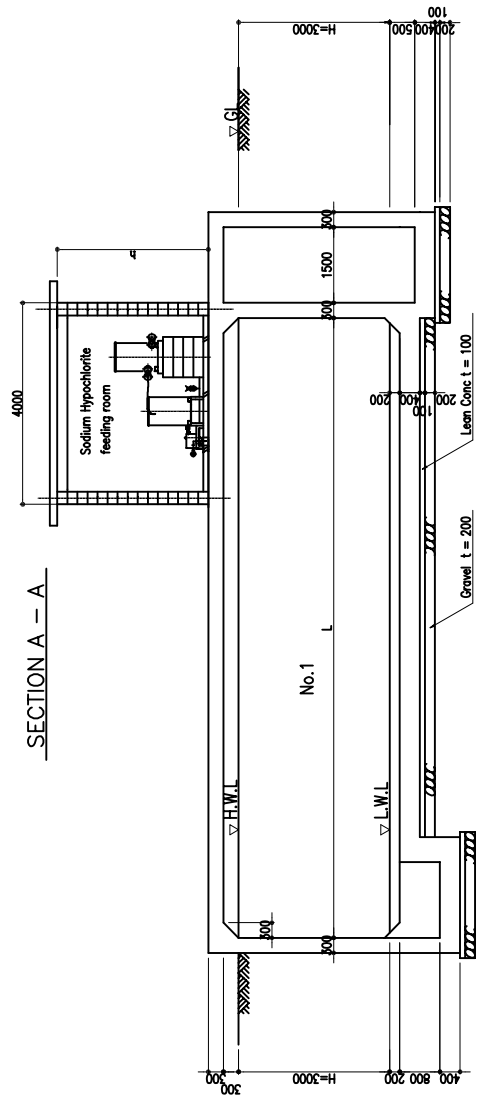


SECTION B - B



B

SECTION A - A



Dimension of Facility

No	Commune	Design capacity (m ³)	Dimension			Number	Capacity	
			W(m)	L(m)	H(m)			
K3-1	Dak Ui	86	3.0	5.0	3.0	4.0	2	90

NO	DATE	APPD	REVISION

NOTE:

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BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM
IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM

Reservoir(Type-1) (K3-1 Dak Ui)

SCALE
1:100

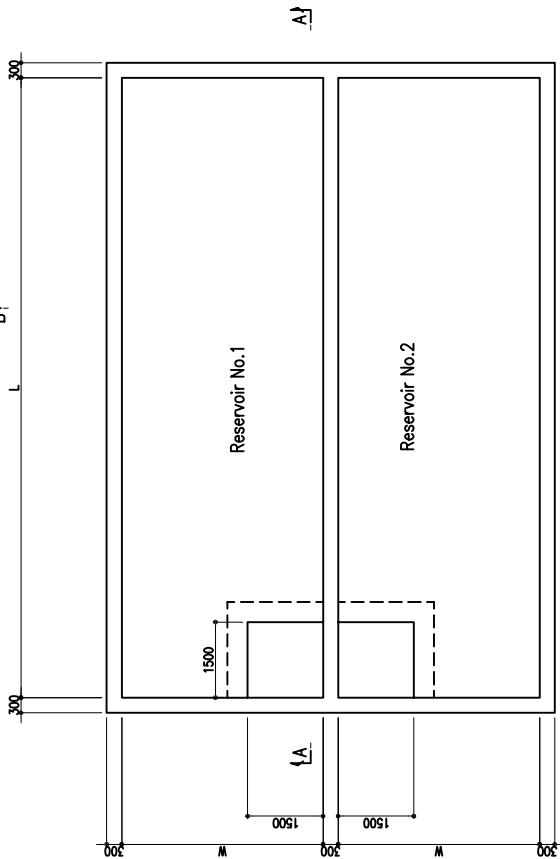
DATE
APPROVED
CHECKED
DRAWN

SCALE
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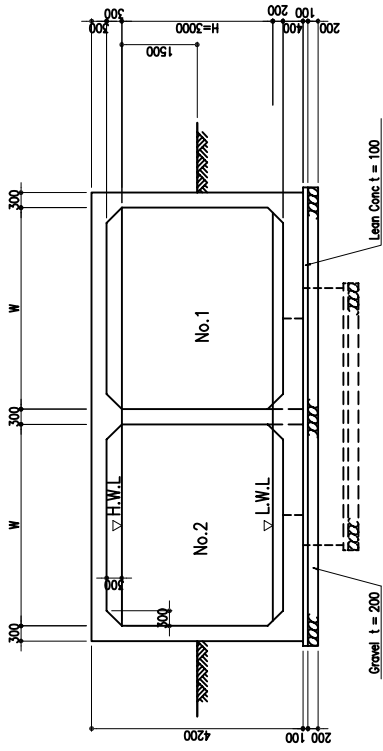
DWG. NO.
(24)

RESERVOIR (Type-2)

PLANE B

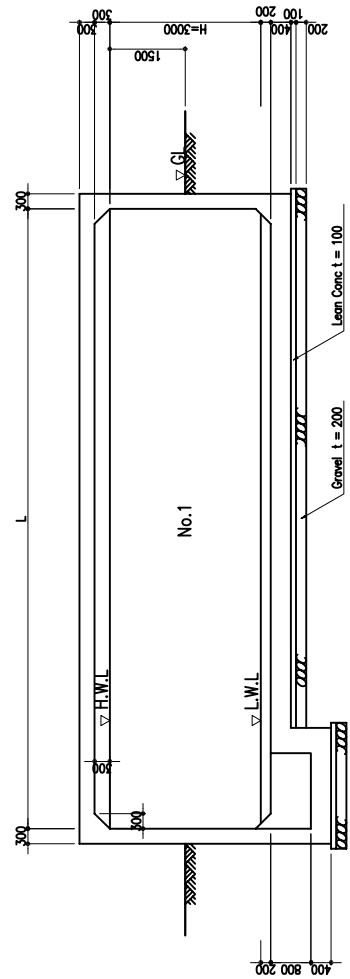


SECTION B - B



Bj

SECTION A - A



Dimension of Facilities

No	Commune	Design capacity (m ³)	Dimension			Number	Capacity
			W(m)	L(m)	H(m)		
G1	Kong Tang	212	4.0	9.0	3.0	2	216
G2	Nhon Hoa	358	4.0	15.0	3.0	2	360
D4-1	Ea Drong	223	4.0	9.5	3.0	2	228

NO	DATE	APPD	REVISION

NOTE:

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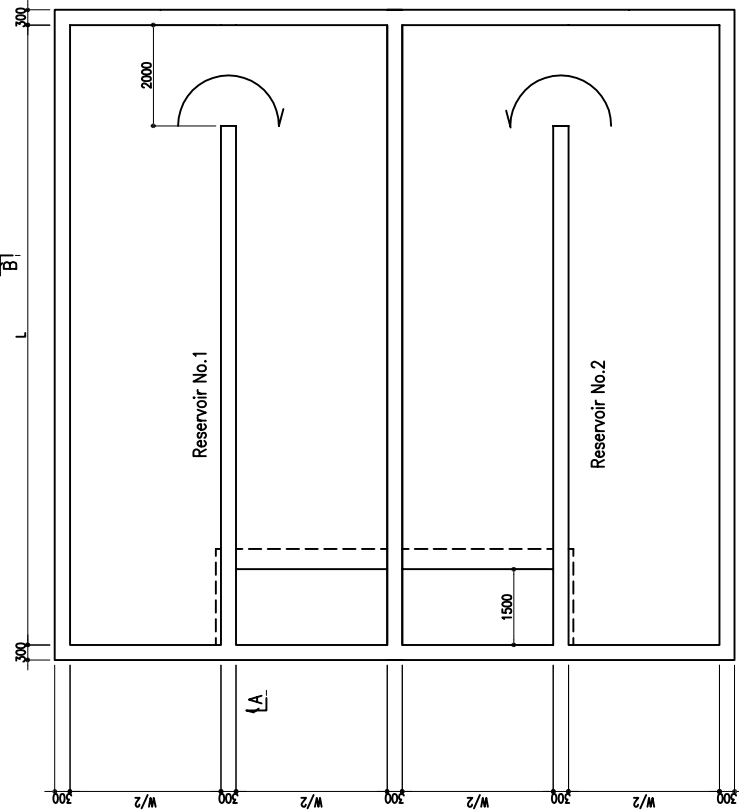
BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM
Reservoir(Type-2)
(G1 Kong Tang, G2 Nhon Hoa, D4-1 Ea Drong)

DATE	APPROVED

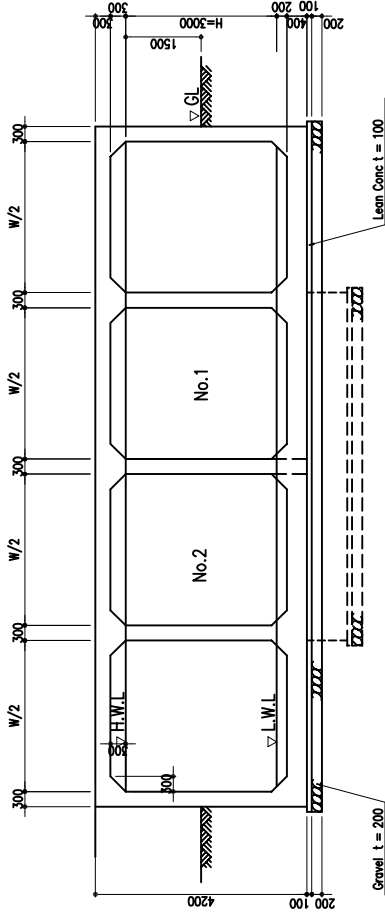
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DWG. NO. (25)

RESERVOIR (Type-3)

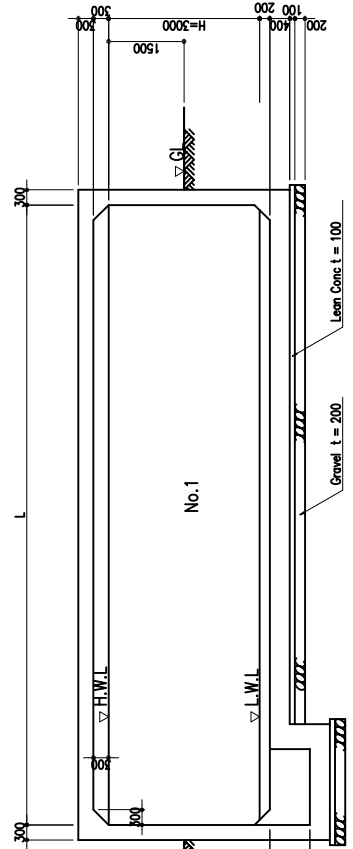
PLANE B-B



SECTION B - B



SECTION A - A



Dimension of Facility

No	Commune	Design capacity (m ³)	Dimension			Number	Capacity	
			W(m)	L(m)	He(m)			
D2	Ea Drang	524	6.0	15.0	3.0	3.5	4	540

NO	DATE	APPD	REVISION

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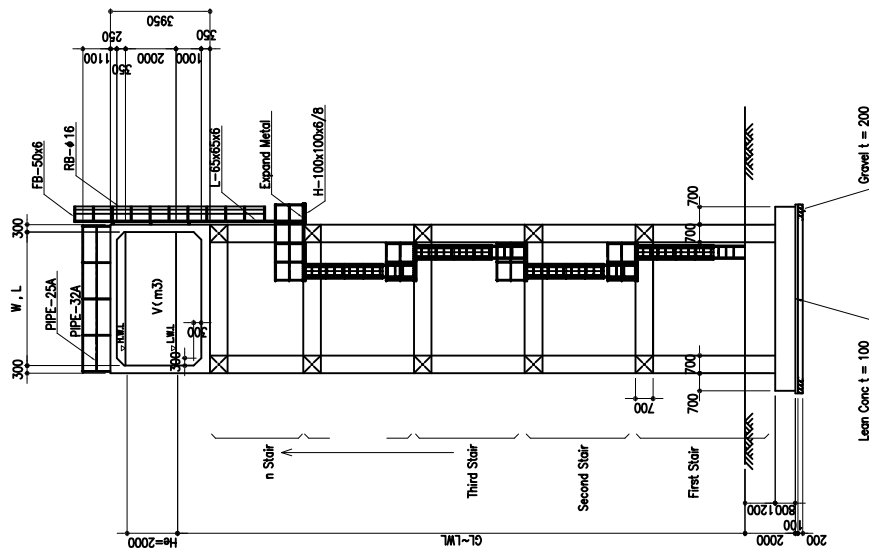
Reservoir (Type-3) (D2 Ea Drang)

DATE	APPROVED

SCALE: 1/100
DWG. NO. (26)

BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM

SECTION



Dimension of Elevated Tank

No	Commune	Design capacity (m ³)	Dimension L(m)		GL~LWL He(m)	Number of Tank	Capacity	Number of Stair
			W(m)	L(m)				
G1	Kong Tang	39	4.4	4.4	2.0	1	39	3
G2	Nhon Hoa	50	5.0	5.0	2.0	1	50	3

No	DATE	APPD	REVISION

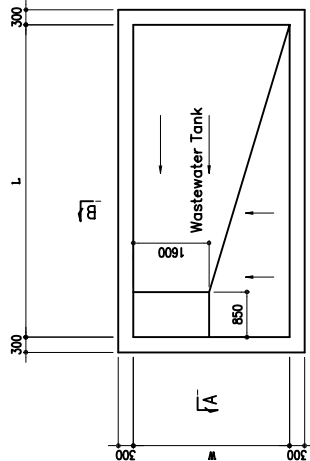
NOTE:

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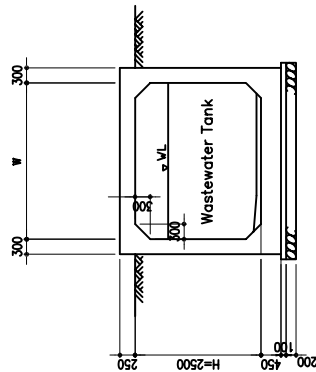
BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM
Elevated Tank(G1 Kong Tang, G2 Nhon Hoa)

DATE	APPROVED CHECKED DRAWN	SCALE	TWIG NO.
		1:100	(27)

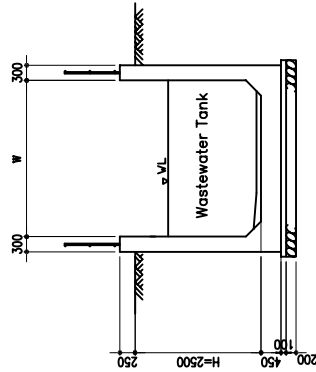
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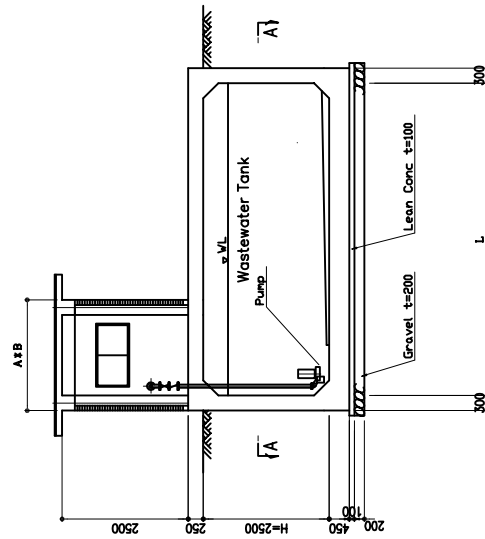
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(Type-1)



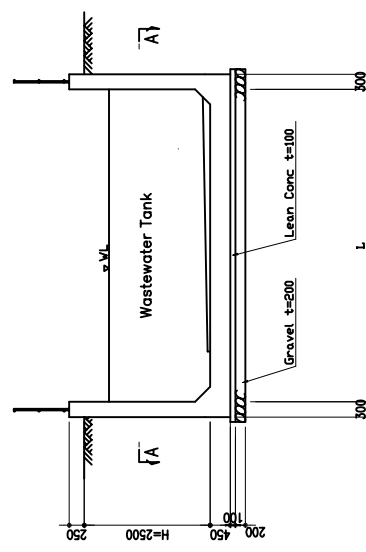
SECTION B-B
(Type-2)



SECTION A-A
(Type-1)



SECTION A-A
(Type-2)



Dimension of Wastewater Tank

No	Commune	Design capacity (m ³)	Dimension			Capacity	Pump House		Remarks
			W(m)	L(m)	Hw(m)		W(m)	L(m)	
K3-1	Dak Uj	86	2.0	1.0	1.0	2	-	-	Type-2
G1	Kong Tang	636	3.0	3.0	2.0	18	1.95	3.35	Type-1
G2	Nhon Hoa	1,075	3.0	5.0	2.0	30	1.95	3.35	Type-1
D2	Ea Drang	1,572	4.0	5.0	2.0	40	-	-	Type-2
D4-1	Ea Drang	668	3.0	3.5	2.0	21	-	-	Type-2

NO.	DATE	APPD	REVISION

NOTE:

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BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM
IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM

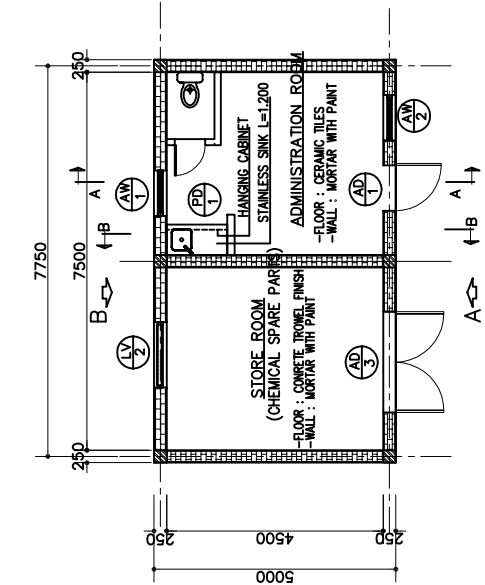
Wastewater Tank (All Communes)

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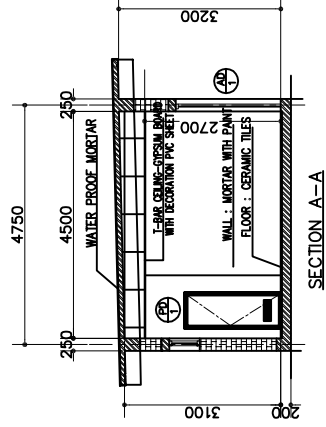
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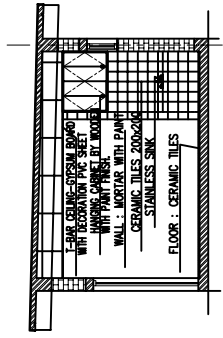
ADMINISTRATION OFFICE



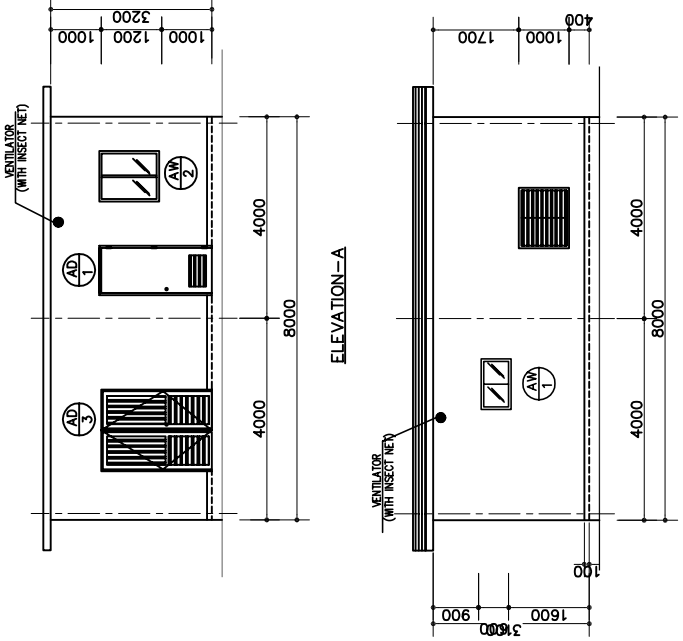
PLAN OF STORE ROOM & ADMINISTRATION ROOM



SECTION A-A



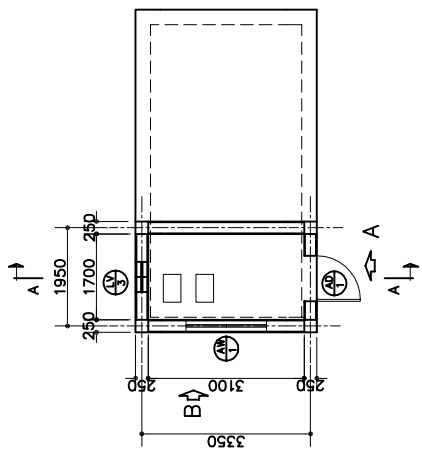
SECTION B-B



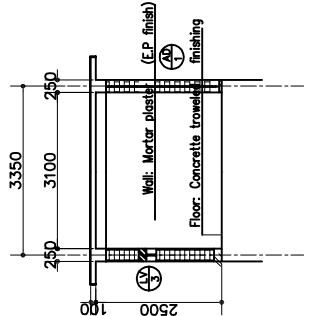
ELEVATION-A

ELEVATION-B

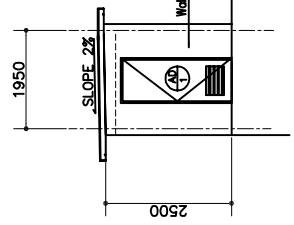
PUMP HOUSE OF WASTEWATER TANK



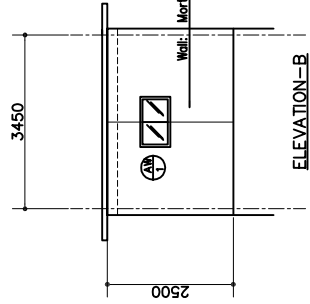
PLAN OF DRAIN PIT ROOM



SECTION A-A



ELEVATION-A



ELEVATION-B

NOTE:

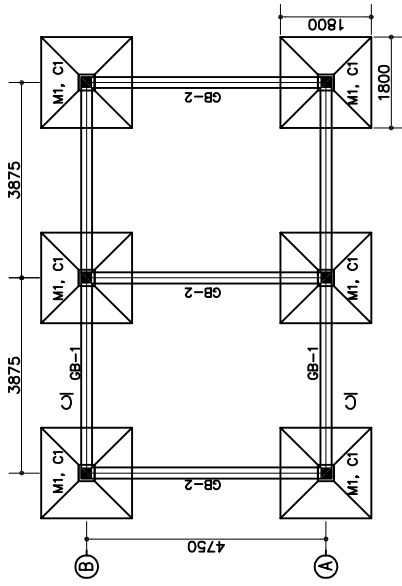
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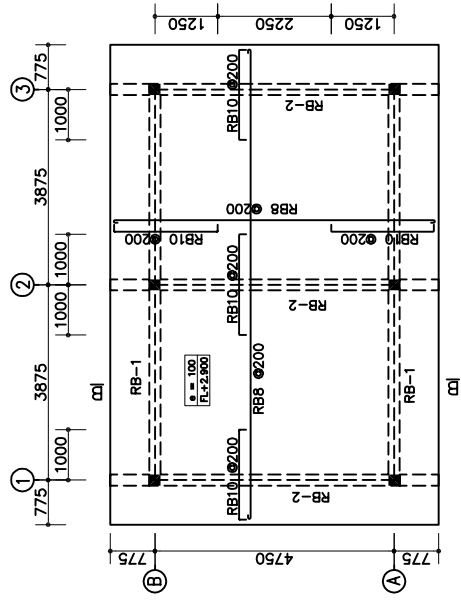
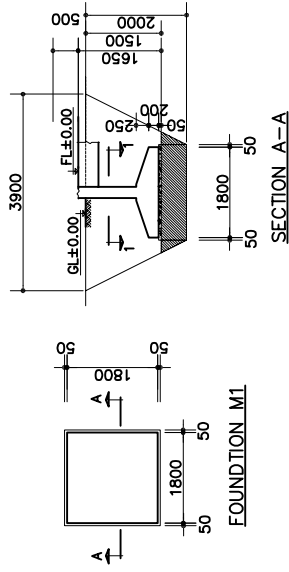
BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM
IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM
Administration Office & Pump House of Wastewater Tank(12)
(All Communes)

DATE	APPROVED
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	(79)

FOUNDATION FOR ADMINISTRATION OFFICE

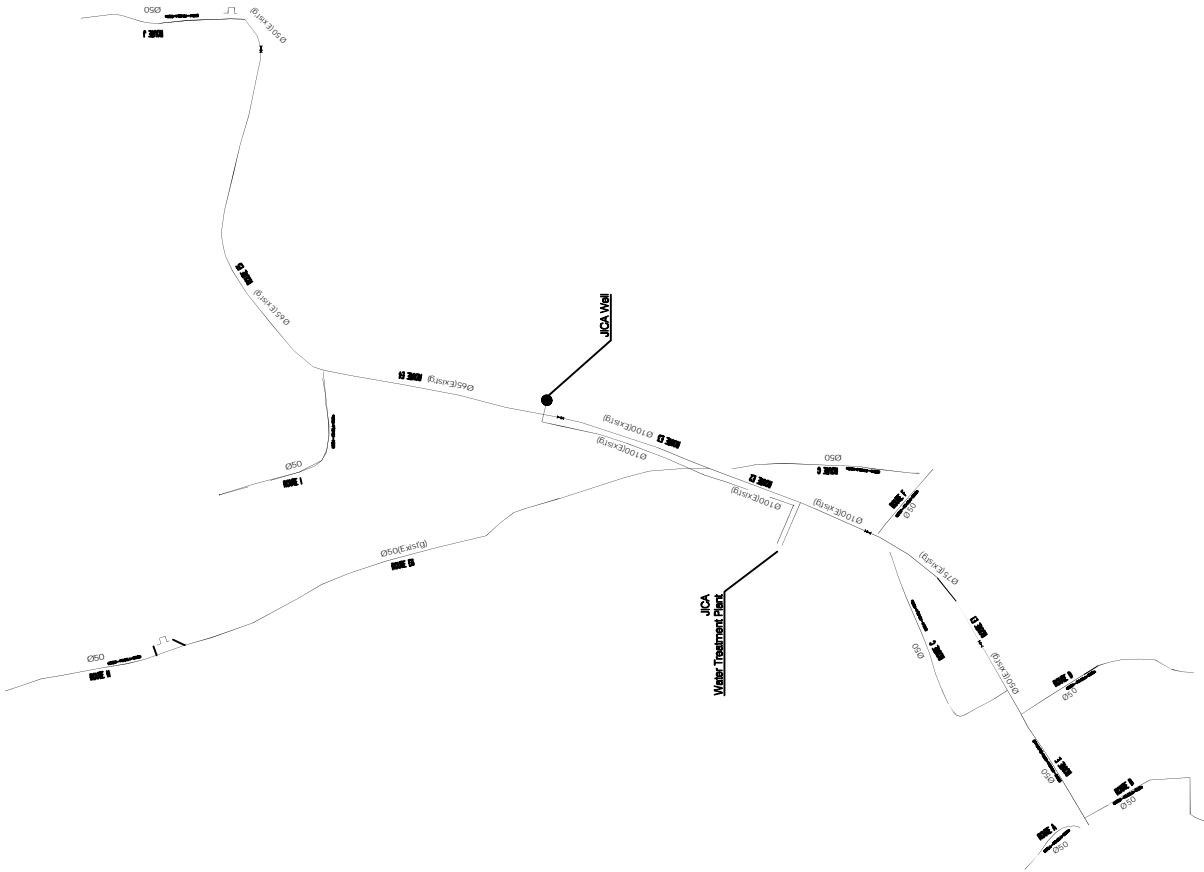


PLAN OF FOUNDATIONS, G- BEAMS AND COLUMNS



REBAR DISTRIBUTION ON ROOF'S SLAB

DATE	APPROVED	CHECKED	DRAWN				
SCALE	BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM						
1:100	Administration Office & Pump House of Wastewater Tank (2/2) (All Communes)						
(30)	JICA JAPAN INTERNATIONAL COOPERATION AGENCY						
NO.	DATE	APP'D	REVISION				



APPROVED	DATE
CHECKED	SCALE
DRAWN	1:100
DWG. NO. (31)	

BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM
IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM

Plan of Pipeline (K3-1 Dak U)



NO.	DATE	APPD.	REVISION



NO.	DATE	APPD	REVISION	NOTE:	JICA JAPAN INTERNATIONAL COOPERATION AGENCY	BASIC DESIGN STUDY ON THE PROJECT FOR RURAL WATER SUPPLY SYSTEM IN CENTRAL HIGHLANDS IN THE SOCIALIST REPUBLIC OF VIETNAM	DATE	APPROVED
							SCALE	CHECKED
					Plan of Pipeline(D2 Ea Drang)		DWG NO.	
							(34)	
							SCALE	
							1:100	
							DRAWN	
							CHECKED	

2-2-4 Implementation Plan

2-2-4-1 Implementation Plan

The Project will be implemented in the framework of the grant aid program of Japan. Therefore, the Project will be implemented only after the Project is approved by the Government of Japan and the Exchange of Notes (E/N) is concluded between the two Governments. The following items are considered for the Project implementation.

(1) Executing Agency

CERWASS under the MARD is an executing agency, and Project Management Unit (PMU) will be organized in CERWASS at the stage of the implementation of the Project.

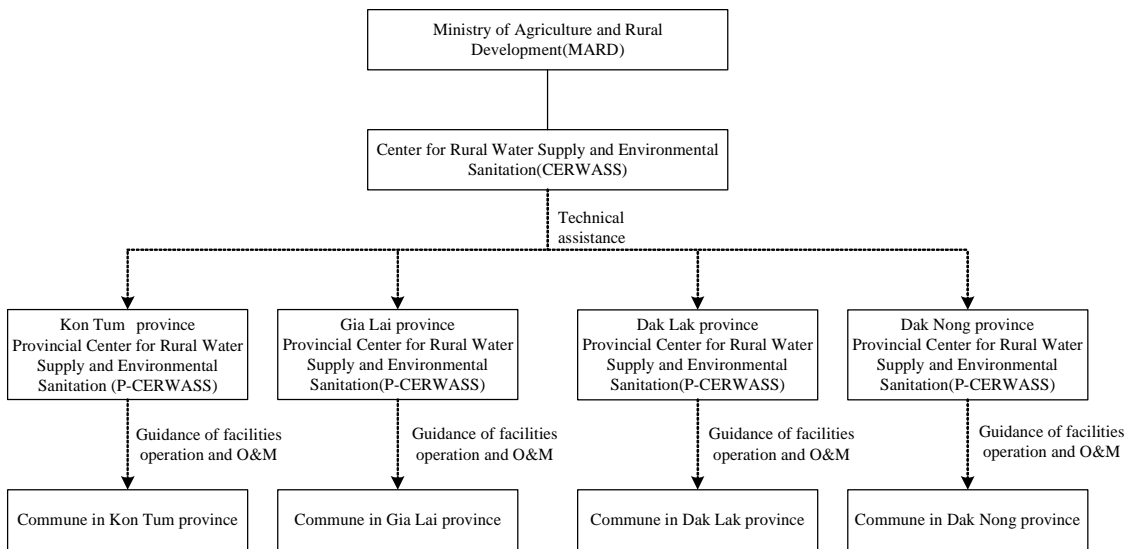


Figure 2.4 Executing Agency

(2) Necessity to Dispatch Contractor's Engineers

The water supply facilities of the Project consist of the civil structures, architectural structures, pipeline installation, mechanical equipment and electrical equipment. For these constructions, civil engineers, architectural engineers, mechanical engineers and electrical engineers are required.

Table 2.24 Dispatched Engineer and Skilled Worker

Item	Water supply facility	Dispatched engineer from Japan	Dispatched skilled worker from Japan
Structure	Well Sedimentation basin Rapid sand filter Distribution reservoir Elevated tank Washing waste chamber	Civil Engineer	Shuttering Carpenter
Building and House	Well shed Aeration chamber Chemical store room Administration building Pump building	Architect	
Laying Pipes	Conveyance pipe Distribution pipe	Civil Engineer	
Mechanical Equipment	Well pump Aerator Rapid sand filter Washing equipment of filter basin pH control Chlorinator Lifting pump Supply pump Drainage pump	Mechanical Engineering	Mechanician
Electrical Equipment	Electrical power distribution equipment Instrumentation equipment Control equipment	Electrical engineer	Electrician

(3) Utilization of Local Construction Companies

There are two types of construction companies in Vietnam. One is the state construction company and another is the private construction company. The large-scale construction works in the project area are contracted to the large construction companies in Hanoi or Hochiminh City. The local construction companies have only the experience of small or medium size construction works. Their construction machinery is imported from Japan or Korea as the second-hand and already superannuated.

(4) Procurement of Well Drilling Equipment

a) Transportation

- Scope: The procured equipment has to be transported from Yokohama Port of Japan to the head office of CERWASS in Hanoi.

- Route: The loading port in Japan is Yokohama Port and the unloading port in Vietnam is Hai Phong Port, that is a main port in the north of Vietnam. After the customs clearance, the equipment will be transported 120km to the designated place in Hanoi.
- Method: From Yokohama Port to Hai Phong Port, the ocean freight should be used for all the packages by a liner vessel. From Hai Phong Port to the designated warehouse in Hanoi, the well drilling equipment mounted on truck, high-pressure compressor mounted on truck and truck with crane are to be driven by themselves. Other packages could be transported inland by trucks.

b) Assembly

When the drilling rig and the associated equipment are delivered at the designated place, the head office of CERWASS in Hanoi, the assembling works starts. Assembly works consist usually of assembling of well drilling rig and the associated equipment, trial test run of the assembled well drilling rig, training on the operation and maintenance of the assembled rig to the CERWASS staff. However, if the above assembling works is conducted in Hanoi, sufficient time of well drilling works in the 5 communes might not be secured and that might delay the whole water supply construction works. The well drilling works constitute of the critical path in the Project. Therefore, out of the above assembling works, minimum required works are conducted in Hanoi. Then, the equipment is transported to the construction site for immediate use of well drilling. Unhurried components like training to the CERWASS staff will be conducted on the sites during the construction period as an on-the-job training.

2-2-4-2 Implementation Conditions

(1) Permission and/or Authorization for Route of Pipeline Installation

In the Project, pipelines are installed mostly along the national, provincial, district and communal roads. Therefore, CERWASS is expected to obtain permissions and/or authorizations from each road authority prior to start of pipeline laying works.

(2) Information Collection and Detection of Unexploded Ordnance and Land Mines

In the target area, it is assumed that the unexploded ordnance have remained from the American War. It is necessary to collect the information regarding this from the related governmental agencies before the construction commencement. The construction works are to be commenced after the detection and inactivation works of these unexploded explosives are completed by the Vietnamese side.

(3) Concrete Placement in Rainy Season

In the heavy rain, the fresh concrete may be separated and washed away. It is a principle to avoid the concrete placement work in the heavy rain, but when it is unavoidable, it is necessary to consider some measures such as the protection of fresh concrete by covering it with a waterproof sheet, etc.

(4) Concrete Placement in Dry Season and Strictly Required Curing

The concrete of water supply facilities is required to be waterproof. Any cracks in concrete, due to the shrinkage on drying after placement and the temperature change, are unacceptable. Not only the slump control at the time of concrete mixing but also curing with water shower under the direct sunshine during the hardening period after placement, is strictly required.

(5) Procurement of Materials and Equipment for Construction

The required materials and equipment for construction, such as the well casing, pump equipment, water treatment equipment, pH adjustment equipment, sodium hypochlorite equipment, electrical measurement equipment and painted plywood are to be procured from Japan. The Portland cement, aggregate, reinforced bars, steel, concrete form, architectural materials, asphalt materials, PVC pipes, PE pipes, stop valve and air valve are possible to procure in Vietnam. The household water meters are procured from the third country, such as Malaysia.

The construction machinery can be leased from the local construction companies in Hanoi or Hochiminh City, etc. The special machinery such as mini-back hoe, wheel loader, breaker, truck with crane, concrete plant, truck mixer, engine generator, high pressure washer, compressor, etc. are to be procured from Japan.

Since the Project is implemented through the grant aid cooperation, the construction should be completed as planned one. Since inadequate procurement of the construction materials and equipment extend the construction period significantly, the study for quality, stock and delivery period in Vietnam, Japan and third countries is to be carried out thoroughly in advance.

(6) Procurement of Well Drilling Equipment

The management of procurement procedure including transportation and assembly is to be in an appropriate manner, because the facility construction will immediately start after this procedure.

2-2-4-3 Scope of Works

- **Construction**

(1) Scope for Japanese Side

Japanese side is responsible for the works listed in the following Table:

Section	Facility	Contents of responsibility	Kon Tum	Gia Lai		Dak Lak	
			Dak Ui K3-1	Kong Tang G1	Nhon Hoa G2	Ea Drang D2	Ea Drong D4-1
Water Intake	Well Facilities	Deep Well	Utilization of Existing				
	Building Facilities	Well Shed					
	Mechanical Equipment	Submersible Pump					
		Flow Meter					
Electrical Equipment	Distribution Panel						
	Control Panel						
Conveyance Pipe	-	Conveyance Pipe	Utilization of Existing				
Water Treatment Plant	Water Treatment Facilities	Aeration Chamber	Utilization of Existing				
		Sedimentation Basin	Utilization of Existing				
		Middle Velocity Filter	Utilization of Existing				
		Rapid Sand Filter					
		Distribution Reservoir					
	Building Facilities	Elevated Water Tank					
		Administration Building					
	Mechanical Equipment	Lifting Pump Building					
		Rapid Sand Filter Equipment			Manganese Sand		
		Surface Washing Pump					
		Surface and Backwashing Pump					
		Lifting Pump					
		Aeration Equipment	Utilization of Existing				
		Sedimentation Basin Equipment	Utilization of Existing				
		Supply Pump					
Flow Meter							

Section	Facility	Contents of responsibility	Kon Tum	Gia Lai		Dak Lak	
			Dak Ui K3-1	Kong Tang G1	Nhon Hoa G2	Ea Drang D2	Ea Drong D4-1
		Water Level Meter					
	pH Control Equipment	Mixing Tank (Sodium hydroxide)					
		Dosing Tank					
	Disinfection Equipment	Mixing Tank (Sodium hypochlorite)					
		Dosing Tank					
	Electrical Equipment	Distribution Panel					
		Control Panel					
Distribution Pipe	-	Distribution Pipe					
Individual Service Pipe	-	Ferrule Provided with Saddle (only material)					
		Service Pipe (only material)					
		Meter (only material)					

(2) Scope for Vietnamese Side

Vietnamese side is responsible for the following works in the three provinces:

Section	Contents of responsibility	Kon Tum	Gia Lai		Dak Lak	
		Dak Ui	Kong Tang	Nhon Hoa	Ea Drang	Ea Drong
		K3-1	G1	G2	D2	D4-1
Water Intake	Land acquisition					
	Land creation				1 Location	
	Access road					
	Land Leveling					
	Gate & Fence					
	Incoming feeder line					
Water Treatment Plant	Land acquisition					
	Land Leveling					
	Access road					
	Land creation					
	Gate & Fence					
	Incoming feeder line					
Water Supply Facilities	Laying individual service pipe					
Others	Disposal of unexploded ordnance					
	Provision of faucet					
	Drain ditch					

● Equipment

The well drilling equipment is procured and supplied to the CERWASS. After that, the procured equipment is transported to the construction site and utilized for the wells drilling under the management of a Japanese contractor in the Project.

(1) Scope for Japanese Side

Japanese side is responsible for equipment procurement, packing, ocean freight and inland transportation from Hai Phong Port to CERWASS in Hanoi, opening packages of equipment in CERWASS, checking the quantity, trial operation, assembly and adjustment before transporting to the site.

The installation and assembling works of equipment, are to be carried out at the site of the facility construction. At the CERWASS for technology transfer, the verification and the hand over will be carried out after the confirmation of mobility and trial operation under the no load conditions.

(2) Scope for Vietnamese Side

Vietnamese side is responsible for Custom clearance procedure when it is procured and operation and maintenance after the completion of the Project.

For operation & maintenance, setting up “Equipment Team” is included in scope works for Vietnamese side.

For the execution of procurement plans for the equipment, the items of responsibility for the Japanese side and Vietnamese side are shown below.

Table 2.25 Scope of Vietnamese side and Japanese side

No.	Contents of responsibility	Japanese side	Vietnamese side
1.	Well Drilling Rig		
2.	Cost for the procurement of equipment		
3.	Cost for the transportation and packaging of equipment		
4.	Cost for installation, test run and arrangement of equipment		
5.	Vehicle registration, insurance and tax		
6.	Inspection and test drive, when equipment is delivered		
7.	Custom duty and Excise clearance		
8.	Operation and maintenance of equipment after the completion of the Project, Setting up Equipment Team		

2-2-4-4 Construction Supervision

● Construction

(1) Organization of Survey and Design

The detailed design and tendering works are to be implemented in Japan. The activities included in detailed design and tendering works are listed below.

- Field survey (in Vietnam)
- Detailed design
- Cost estimation
- Preparation for tender document
- Approval of tendering document
- Tender announcement
- Prequalification of the tenderer
- Pre-bid meeting
- Evaluation of tenderer and tender document

(2) Organization of Supervision

a) Contents of Supervision

The main components of supervision activities are listed below

- Management of schedule and quality control
- Study and assessment of design modification
- Preparation and submission of progress report
- Safety control
- Completion inspection

These are continuing works from the commencement to the completion of the Project. Therefore, the resident engineer would be stationed at the project site throughout the Project period.

b) Site Office

The site office for project management consultant shall be located as given in below.

- First site office : Dak Lak Province, Ea Drang (D2) Commune
- Second site office : Gia Lai Province, Plei Ku

● Equipment

Work is classified into the detailed design and procurement supervision. The contents and the staffing plan of each work are described below.

(1) Organization of Detailed Design

The contents of detailed design are mentioned below.

- Final confirmation of project contents
- Preparation of tender documents
- Explanation and approval of tender documents
- Notice of pre-qualification and its evaluation
- Public notice of tender and delivery of tender documents
- Tender and tender evaluation

(2) Organization of Procurement Supervision

The contents of procurement supervision are mentioned below.

- Inspection of shop
- Inspection of equipment before shipment

Staffing Plan for Procurement Supervision is shown in Table below.

Table 2.26 Staffing Plan for Procurement Supervision

Post	Rank	Total (M/M)	Period of dispatch
Project manager (Served by facility plan)	2	0	Final inspection
Supervisor of procurement	3	0.23	From equipment installation to final inspection
Engineer of acceptance inspection (in Japan)	3	0.27	Acceptance inspection
Total		0.50	

2-2-4-5 Quality Control Program

The Project is composed of civil works, architectural works, mechanical equipment works and electrical equipment works for the intake facilities, water treatment facilities, distribution facilities and pipelines of conveyance and distribution. For these construction works, the quality control is to be carried out for the control items of each construction activity as shown below.

Table 2.27 Methods of Quality Control

Category of Work	Control Item	Method	Frequency
Piping Material	Strength/Dimension	Confirmation of Factory Certificate	Every time for Approval
	Appearance/Dimension	Visual Check/Measurement of Dimension	Every time of Delivery at Site
Pipe Laying Work	Installed Condition of Rubber Gasket	Check Gauge	
	Torque Strength	Torque Wrech	
	Welding	Dye penetration	
	Water Leakage	Water Pressure Test	Entire Length of Pipeline
Concrete Work	Aggregates	Particle Size Test	Every Quarry
	Cement	Confirmation of Quality Certificate	Every Place of Procurement
	Fresh Concrete	Slump	Every time of Casting
	Concrete Strength	Compressive Strength Test	Place of Casting or Every 150m ³
Rebars	Strength	Confirmation of Quality Certificate	Every Place of Procurement
	Arrangement of Rebars	Check of Diameter and Interval	Every time of Casting
Finished Work Quality	Visual Inspection and Dimension Check	Visual Check and Measurement of Dimension	Major Members/Places of the Structures
Water Proofing	Quality of Material	Confirmation of Quality Certificate	Every time for Approval
	State of Water Proofing	Visual Check	Structure Same as above
	Water Leakage	Leak Test by Filling Water	
Mechanical Work Electrical Work	Accuracy of Setting	Measuring the Setting Position	Every Equipment
	Function	Load Test	Every Equipment during the Test
Water Quality	Tap Water Quality	Water Quality Test	Before Starting the Service

The following is controlled for the well drilling equipment.

- Shop inspection
- Adjustment and trial operation, Initial operation guidance, Supervision of the operation and maintenance

2-2-4-6 Procurement Plan

(1) Procurement of Construction Materials and Equipment in Vietnam

The procurement of main materials and equipment to be used in the project are shown in Table 2.28.

Table 2.28 Source of Procurement of Major Materials and Equipment

Category	Materials & Equipment	Vietnam	Japan	Third Country	Remarks
1. Aggregates/Cement	Aggregates (sand/crushed gravel)				
	Cement				
	Baked-Mud				
	Asphalt Compounds				
2. Fuel	Gasoline				
	Diesel Oil				
	Fuel Oil				
3. Articles of Iron or Steel	Deformed Bar				
	H-Section Steel				
	I-Section Steel				
	L-Section Steel				
	C-Section Steel				
	Sheet Steel				
4. Temporary Work	Timber for framework				
	Coating Chipboard				
	Metallic Material for tightening framework				
	Waterproof Ring				
	Timber				
	Scaffolding				
	Timbering				
5. Material for water supply and sewerage	Slit type Screen (FRP)				For Well
	Poly-vinyl Chloride Pipe (PVC)				Rubber Gasket T
	Poly-ethylene Pipe (PE)				Service pipe
	Galvanized Steel Pipe				
	Concrete Pipe (CP)				
	Sluice Valve				
	Air Valve				
	Water Meter				Malaysia
	Cooperation Cock				
Faucet					
6. Material for Building Work	Inner Package/Exterior Package				
	Fittings				
	Water Service/Sanitation/Drains				
	Building Mechanical Equipment				
	Building Electrical Equipment				
7. Mechanical Equipment	Submersible Pump for Well				
	Volute Pump of Horizontal Shaft				
	Aeration Equipment				
	Rapid Sand Filter Equipment				
	Lower Perforated Devise of Filter				
	Gravel for Filter				
	Sand for Filter				
	Manganese Sand				
	pH Control Equipment				
	Disinfection Equipment				
	Piping for Machine				
	Flow Meter (Woltmann Type)				
Water Level Meter (Float Type)					
8. Electrical Equipment	Distribution Panel				
	Electrical Cable				
	Sheath Pipe				

(2) Procurement for Well Drilling Equipment in Japan

It is planned that the well drilling equipment is procured in Japan. The countries where the well drilling equipment is manufactured are only China, Korea, India and Thailand in Asia excluding Japan. Observing the actual situation of existing well drilling equipments in Vietnam, most of them were imported from Russia.

Concerning the well drilling equipments of made in China, made in Asia and made in Russia, there are some problems in terms of the capacity and durability. The Government of Vietnam has pointed out that these equipments are not suitable for the Project. Consequently, it is adequate to procure it from Japan. Concerning the supporting equipments and materials, the procurement from Japan is also planned to meet the specification and industrial standard of the well drilling equipment.

2-2-4-7 Implementation Schedule

The implementation schedule is mentioned below (refer to Table 2.29).

(1) Detailed Design

Field Survey in Vietnam	1.5 months
Design in Japan	2.0 months
Finalization	0.5 month

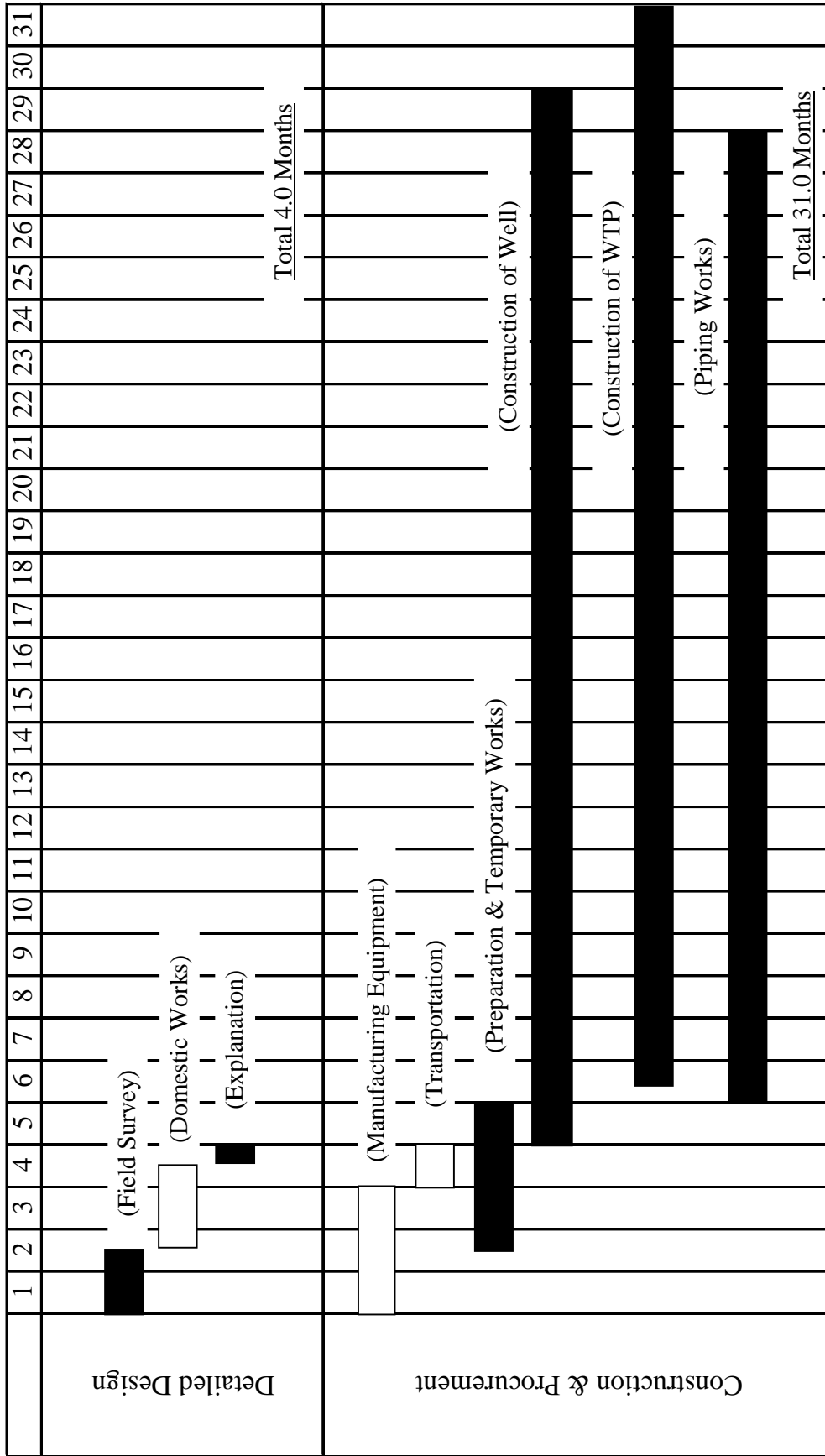
(2) Provision of Equipment

Manufacturing of well drilling equipment	3.0 months
Transporting of well drilling equipment	1.0 month

(3) Construction Plan

Mobilization/ Temporary Works	3.5 months
Construction of wells	25.0 months
Construction of WTPs	25.5 months
Piping Works	23.0 months

Table 2.29 Implementation Schedule



2-3 Obligations of the Recipient Country

For the Project implementation, the following works has to be undertaken by the Government of Vietnam.

(1) Kon Tum

Communes	Categories	Items	Contents
1) Dak Ui (K3-1)	Well	Gate	H=1.8m W=2.0m N=1
		Fence	H=1.8m L=36.0m
	Water Treatment Plant	Land acquisition	Public Land (CPC)
		Access road	W=4.0m L=550m
		Land leveling	A=690m ²
		Gate	H=1.8m W=4.0m N=1
	Others	Fence	H=1.8m L=103.6m
		Laying individual service pipe	L=12,480m
		Faucet	N=624
		Clearance of unexploded ordnance	Construction Site
		Drain ditch	L=100m

(2) Gia Lai

Communes	Categories	Items	Contents
1) Kong Tang (G1)	Well	Land acquisition	No.1 Private land A=100m ²
		Land leveling	A=100m ²
		Gate	H=1.8m W=2.0m N=2 (including existing)
		Fence	H=1.8m L=72.0m (2 places)
		Incoming feeder line	No.1 L=10m Existing J1 L=10m
	Water Treatment Plant	Land acquisition	Public Land (CPC)
		Land leveling	A=1352m ²
		Gate	H=1.8m W=4.0m N=1
		Fence	H=1.8m L=143.3m
	Others	Incoming feeder line	L=10m
		Laying individual service pipe	L=34,760m
		Faucet	N=1,738
		Clearance of unexploded ordnance	Construction Site
		Drain ditch	L=100m
2) Nhon Hoa (G2)	Well	Land acquisition	No.1 Public Land (CPC) No.2 Public Land (Elementary school) No.3 Private land A=100m ² No.4 Private land A=100m ² No.5 Private land A=100m ² No.6 Public Land (Elementary school)
		Land leveling	A=300m ²
		Gate	H=1.8m W=2.0m N=7 (including existing)
		Fence	H=1.8m L=252.0m (7 places)

Communes	Categories	Items	Contents
		Incoming feeder line	No.1 L=110m No.2 L=10m No.3 L=750m No.4 L=10m No.5 L=900m No.6 L=380m
	Water Treatment Plant	Land acquisition	Public Land (CPC)
		Access road	W=4.0m L=450m
		Land leveling	A=1479m ²
		Gate	H=1.8m W=4.0m N=1
		Fence	H=1.8m L=150.3m
	Others	Incoming feeder line	L=160m
		Laying individual service pipe	L=43,620m
		Faucet	N=2,181
		Disposal of unexploded ordnance	Construction Site
		Drain ditch	L=100m

(3) Dak Lak

Communes	Categories	Items	Contents	
1) Ea Drang (D2)	Well	Land acquisition	No.1 Public Land (Elementary school) No.2 Private land A=100m ² No.3 Private land A=100m ² No.4 Private land A=100m ² No.5 Public Land (Army) No.6 Public Land (CPC) No.7 Public Land (CPC)	
		Land leveling	A=300m ²	
		Gate	H=1.8m W=2.0m N=7	
		Fence	H=1.8m L=252.0m (7 places)	
		Incoming feeder line	No.1 L=10m No.2 L=400m No.3 L=20m No.4 L=20m No.5 L=400m No.6 L=140m No.7 L=5m	
		Water Treatment Plant	Land acquisition	Public Land (Army)
			Access road	W=4.0m L=550m
	Land leveling		A=1520m ²	
	Gate		H=1.8m W=4.0m N=1	
	Fence		H=1.8m L=152.3m	
	Others	Incoming feeder line	L=570m	
		Laying individual service pipe	L=77,480m	
		Faucet	N=3,874	
		Clearance of unexploded ordnance	Construction Site	
			Drain ditch	L=100m

Communes	Categories	Items	Contents
2)Ea Drong (D4-1)	Well	Land acquisition	No.1 Private land A=100m ² No.2 Private land A=100m ²
		Land leveling	A=200m ²
		Gate	H=1.8m W=2.0m N=3 (including existing)
		Fence	H=1.8m L=108.0m (3places)
		Incoming feeder line	No.1 L=250m No.2 L=110m Existing J1 L=110m
	Water Treatment Plant	Land acquisition	Public Land (CPC)
		Land leveling	A=1364m ²
		Gate	H=1.8m W=4.0m N=1
		Fence	H=1.8m L=144.1m
		Incoming feeder line	L=1,400m
	Others	Laying individual service pipe	L=31,660m
		Faucet	N=1,583
		Clearance of unexploded ordnance	Construction Site
		Drain ditch	L=100m

(4) Well Drilling Equipment

No.	Contents of responsibility
1.	Vehicle registration
2.	Inspection and test drive, when equipment is delivered
3.	Custom duty and Excise clearance
4.	Securing of personnel for operation and maintenance of equipment after the completion of the Project, Construction cost of the equipment Team, Securing of the storage for equipment

(5) Others

No.	Contents of responsibility
1.	Temporary work field
2.	Computer, printer and software (for Soft-Component)
3.	Management Cost of PMU(Project Management Unit) in CERWASS
4.	Management Cost of PMU(Project Management Unit) in P-CERWASS
5.	Cost of Bank Proceeding

2-4 Project Operation Plan

● Construction Plan

2-4-1 Present Status and Major Issues of Operation and Management of Water Supply Facilities

Rural water supply facilities in Vietnam, after completion, are transferred to the ownership of the CPC or other local community organization. The local residents employed by the CPC, under the assistance of P-CERWASS, are basically in charge of the operation and maintenance

of facilities. As facility operation and maintenance by the local community is a CERWASS's policy, the above system will be adopted for the Project. However, for Dak Lak and Dak Nong P-CERWASS, where the CPC's capacity is concerned, the constructed facilities will be directly managed by P-CERWASS for five years after completion and then will be transferred to the respective CPCs.

Based on the analysis of the present facility operation and maintenance system and the results of the pilot project, which was carried out during the JICA Development Study, the following problems and issues are pointed out.

- 1) There are no large-scale water supply facilities in the project area. Therefore, the local organizations have little experience in operation and maintenance of the water supply system that will be constructed under the Project.
- 2) As the ownership of the rural water supply service has been transferred from MOLISA to MARD only some ten years ago, neither the CERWASS nor P-CERWASS (the core organization responsible for facility operation and maintenance) have sufficient number of personnel with expertise in the water supply except drilling. Also, while MARD has expertise in groundwater resource development since its original jurisdiction includes geological exploration, it does not have sufficient resource to provide education and training of personnel engaged in water supply service.
- 3) The CERWASS deals with rural water supply service throughout the country with limited staff and is not in a position to understand water supply conditions accurately at commune levels.
- 4) Similar to the above, the CPC, which will be responsible for actual facility operation and periodical inspection, lacks expertise and experience in water supply service, since most of the existing water supply facilities are shallow wells owned by individuals.
- 5) The method for communication between P-CERWASS and CPC or the chain of command and control is not established.
- 6) In some communes, IEC activity is not fully carried out and there is lack of awareness among the residents on the importance of water supply.

In order to deal with the above issues, it is important for the communes to be covered under the Project to establish not only cooperation among CERWASS, P-CERWASS and CPC, but

also a collaborative system and a communication channel with other water-related organizations.

2-4-2 Operation and Maintenance

In order to ensure smooth operation and maintenance of new water supply facilities, a new organization should be established to allow self-sustainable operation based on revenue from water charges.

The JICA development study report recommends that new water supply facilities are operated and maintained by a commune-led organization, and the communes appear to have high levels of the *esprit de corps* and organizing ability as judged from activities of various local cooperatives and organizations. As pointed out earlier, however, the results of the present study and the pilot project indicate that it is very difficult for the commune to operate and maintain a large-scale water supply system due to the shortage of adequate human resources. Thus, as shown in Figure 2.5, the study team recommends the establishment of the water management unit (WMU) with P-CERWASS being the project implementation body.

This arrangement is modeled after the organization adopted for the “Project for the Groundwater Development in Rural Part of Northern Provinces” funded by the Japanese Government. In addition to the original form, the study team proposed to add an advisory group in the organization. The advisory group has been conceived in reflection of a major lesson learned from the pilot project, where P-CERWASS was unable to provide effective support for commune staff who faced an unforeseen accident in the course of the project, due to the lack of knowledge and experience in the large-scale water supply system. Unlike the northern project that is carried out nearby Hanoi, where there are a number of urban water supply organizations that can provide technical assistance for the project implementation body, a rural commune located in the central highlands cannot have access to such “technical guide” to ask for advice relating to day-to-day operation and maintenance of the water supply system. However, there are water supply and sewerage corporations under the MOC, which are located in provincial capitals and other urban areas and are engaged in operation and maintenance of modern water supply systems including water treatment plants and pipeline networks. Also, in some provinces, DARD, which supervises P-CERWASS, directly manages large-scale water supply facilities. Furthermore, water supply facilities that have been constructed by the PPC or DPC under the finance of the central government’s rural development fund are, exceptionally, operated and maintained by water management division in DPC.

As expertise and experience in operation and maintenance of these water supply systems and organizations can be adopted by the new WMU, it is important for the WMU to establish communication channels with these organizations in order to deal with any problem encountered in the course of operation quickly.

In Dak Lak and Dak Nong Provinces, a plan has been proposed to each provincial assembly for adoption of system change to enable P-CERWASS to manage all water supply facilities in the respective province by taking into account the needs for streamlining facility operation and maintenance and ensuring a stable water quality. In both provinces, the plan has been approved by MARD and DARD, and the two provincial governments are currently waiting for the result of deliberations by the provincial assembly.

Nonetheless, since the targeted communes in each Province are very few in number (1 to 2 communes/Province), it is presumed to be difficult to establish the WMU until the targeted communes increase up to the certain number. Thus, for the Project, only operation centers in five communes are to be established for the management including operation of the facility and collection of water charges, etc. As shown in the figure 2.5, the operation center is a subordinate body under the WMU.

The operation centers in 5 communes will be established prior to the establishment of WMU. In order to operate the water supply facilities, the management system will be set up before the completion of the water supply facilities. The training for the staff of the operation center will be implemented in the soft-component, including the establishment of the operation center, IEC and development of management system. Therefore, minimum extent of the management will be conducted by the operation center.

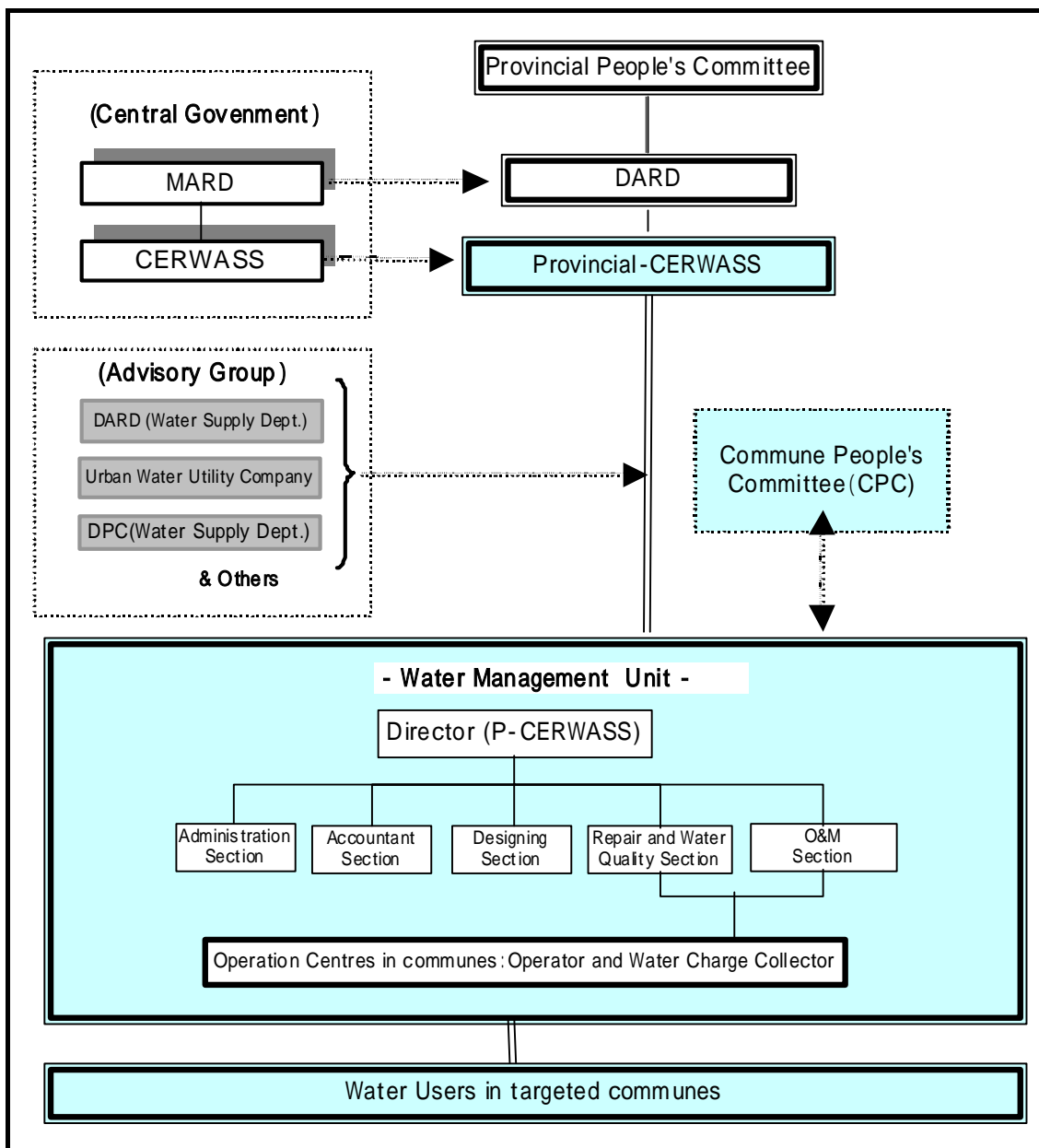


Figure 2.5 Proposed Organization of Operation and Maintenance of Water Supply Systems

2-4-3 Manpower Requirements and Human Resources Development Plan

2-4-3-1 Manpower Requirements for Facility Operation and Maintenance

The WMU's main office staff including the director (administration, finance, design, repair and water quality, and maintenance divisions) should be selected from P-CERWASS as far as qualified personnel are available. If not, they should be hired from outside or P-CERWASS staff should be trained by sending them to a training program or a seminar or by hiring an instructor for field guidance on an OJT basis. Essentially, WMU staff will work with

counterpart divisions of P-CERWASS, such as engineering, design, accounting, and administration.

Table 2.30 shows an example of WMU main office’s organization and staffing. In an actual plan, it is desirable to make it as flexible as possible to allow for actual workloads, future expansion, and other field conditions.

Table 2.30 WMU Main Office Organization and Staffing

(Unit; person)

Name of Province	Director	Administration	Finance	Design	Repair/water quality	Maintenance	Total number of staff
Kon Tum	1	1	1	1	1	1	6
Gia Lai	1	1	1	2	1	2	8
Dak Lak	1	1	1	2	1	2	8

The principal role of main office in WMU’s facility operation and maintenance service is to check the status of facility operation by visiting communes covered under the Project. Also, it should solve problems related to facility operation and maintenance and refer those, which cannot be solved within the WMU, to P-CERWASS or the advisory group for advice or guidance. Responsibilities of the main office’s divisions are summarized as follows.

Table 2.31 Division of Responsibilities at WMU Main

Division	Responsibility
Director	Principal officer, negotiation with P-CERWASS and advisory group
Administration	Customer management on households connected to the water supply system, management of the facility list, and personnel management and general administration
Finance	Administration of collection of water charges, WMU revenue and expenditure management
Design	Water supply facility (pipes and water meters, etc.) construction planning, design and construction management
Repair/water quality	Technical guidance for facility repair, and water quality control
Maintenance	Technical guidance for operation of the water treatment plant and chlorine feeding facility

Under the WMU’s repair/water quality and maintenance divisions, facility operators and bill (water charge) collectors will be hired from commune residents as operation centre staff. The operators will check the operating status according to inspection manuals and report results to

the P-CERWASS on a periodical basis. The collectors will be responsible for meter reading, collection of water charges, the monitoring and reporting of users in arrears, and transfer of collected charges to a designated bank account.

The commune operation center's organization and staffing is summarized in Table 2.32. The center will hire four operators in the case of a commune operating a water supply facility equipped with a rapid sand filter and aeration system. The two cases are assumed with consideration of complexity of facility operation and maintenance. Also, the number of charge collectors has been calculated under the assumption that each collector could handle 500 connected households.

Table 2.32 Proposed Organization and Staffing of WMU

Province/Communes	Water Treatment Method	No. of connected households (2010)	Main office staff	Commune operation center		Total Staff
				Operators	Collectors	
Kon Tum			6			
(K3-1) Dak Ui	Medium velocity filtration	624		4	2	
Sub-Total		624	6	4	2	12
Gia Lai			8			
(G1) Kong Tnag	Rapid sand filter	1,738		4	4	
(G2) Nhon Hoa	Rapid sand filter	2,181		4	5	
Sub-Total		3,919	8	8	9	25
Dak Lak			8			
(D2) Ea Drang	Rapid sand filter	3,874		4	8	
(D4-1) Ea Drong	Rapid sand filter	1,583		4	4	
Sub-Total		5,457	8	8	12	28
Total	-	10,000	22	20	23	65

2-4-3-2 Human Resources Development Plan

As discussed earlier, P-CERWASS and communes lack experience in operation and maintenance of large-scale water supply systems, and in course of project implementation, their knowledge and skills should be upgraded to the level to allow sustainable operation of the modern and complex system that will be introduced under the Project. This means, intensive efforts should be made to promote capacity building of WMU staff and other stakeholders who are involved in day-to-day facility operation and maintenance. As training in Japan and other countries is available to a limited number of participants, other opportunities should be sought, such as training programs and seminars or joint training held by P-CERWASS in the three provinces. It should be noted that P-CERWASS in Dak Lak benefits from DANIDA's human resources development program since 1995 and collaboration with DANIDA is indispensable.

1) Participation in a water supply course of vocational training institutes in Danang and

Hochiminh City

- 2) OJT at water supply facilities operated by the advisory group
- 3) Training at Dak Lak P-CERWASS that has more experience in facility operation and maintenance, compared to other provinces
- 4) Participation in a water management seminar held by CERWASS or other central government organization

In addition, as seen in the case of the “Project for the Groundwater Development in Rural Part of Northern Provinces”, shortly after operation of water supply facilities in different communes has started, a significant difference will emerge in terms of their operation and maintenance levels. At this stage, a workshop should be held by a province or jointly by all the provinces to compare operation and maintenance levels of the facilities and to analyze cause for the difference. The results will provide lessons for improvement of commune facilities where operation and maintenance is not carried out as efficiently as in other communes.

The study team visited a Danang vocational training institute, Puong Dong Economic and Technology, to understand content of the water supply course. The institute is relatively close to the central highland area and sent two graduates to Dak Lak P-CERWASS in 2004. As shown in Table 2.33, the water supply course focuses on water supply management techniques, it also teaches general subjects such as law and management and is thus considered to be based on a curriculum having a broad coverage.

The institute was founded in 1998 under a 50:50 contribution by the MOET and the private sector. According to the principal, the water supply faculty consists of ten full-time and fifteen part-time lecturers who are engineers or technicians sent by water supply corporations throughout the country. The course includes practical training at facilities operated by water supply corporations and graduates from the institute are expected to become a useful workforce on graduating. At present, the course is offered as a full-time course only and lasts ten months for the total tuition fee of 2.5 million VND. The institute intends to add part-time and intensive courses in order to provide opportunity for working people.

Sending of P-CERWASS staff to the course, as selected by the WMU, can lead to the improvement of overall skill levels, although payment of the tuition fee needs to be considered.

Table 2.33 Annual Curriculum of the Water Supply Course at the Puong Dong Training Institute

Subjects of water supply faculty	
I. General subjects	
	1. Politics
	2. Defense education
	3. Sport
	4. Informatics
	5. Foreign language
	6. Law education
II. Basic subjects	
	7. Drawings
	8. Electrics
	9. Mechanics
	10. Hydraulics
	11. Engineering Geodesic
	12. Engineering geology and Hydro geology
	13. Planning and Architects
	14. Specific material
	15. Structure
	16. Water biochemical
	17. Environment protection
III. Specialize subjects	
	18. Water supply and intake, pumping station
	19. Drainage
	20. Construction technical and construction arrangement
Subject for graduate examination	
	1. Practical report
	2. Water supply and intake, pumping station
	3. Drainage

Human resources development will be carried out in consideration of the above factors, 2-6-1 “Software Component Plan,” and relationship with DANIDA that has a strong influence in Dak Lak and Dak Nong. In addition to capacity building of WMU staff, through IEC activities, efforts should be made to improve residents’ awareness on the importance of water supply service.

2-4-4 Water Tariff

The water tariff needs to be determined by taking into account a balance between the facility operation and maintenance costs and residents’ ability to pay the water bills. At present, the CPC or DPC is authorized to determine the water tariff. In the three provinces covered by the project, however, most residents take water from private shallow wells and do not pay the water charge, and hence, there are no uniform procedures for determination of water tariff.

As shown in Appendix 7 “Willingness Survey on Water Supply and Water Charges to All

Households,” the present survey shows that willingness to pay of the water charge in the targeted communes ranges between 14,338 and 33,239VND per month, with the average WILLIGNESS TO PAY for 13 communes covered by the survey being 23,000VND. In terms of affordability for users, the willingness to pay figures are in the range less than from 3% to 5% of income shown in “National Rural Clean Water Supply and Sanitation up to 2010” and are thus considered to be adequate. The results indicate, as shown below in Table 2.34, that the average affordability to pay for all the targeted communes can fully cover the expected production cost for the water supply services. Understandably, it can be seen that sustainable operation of water supply facilities in reliance on water charge is practicable.

Table 2.34 Comparison of Water Production Cost and Affordability to Pay Value by Province

Province	Water production cost (m ³ /VND) × Average consumption (m ³)	Monthly water charge (VND/month/HH)		Affordability to Pay (ATP)	
				3%	5%
Kon Tum	2,282 x 9 =	20,538	<	23,856	39,760
Gia Lai	2,516 x 9 =	22,644	<	54,962	91,603
Dak Lak	2,671 x 9 =	24,039	<	48,387	80,645

(Remark)

The average consumption per household per month is calculated as follows:

$$0.06\text{m}^3 \times 4.9 \text{ persons/household}^* \times 30 \text{ days} = 8.92 \text{ m}^3/\text{month/household} = 9\text{m}^3$$

* 4.9 persons/household were obtained from the socioeconomic survey conducted under this study.

Table 2.35 compares monthly water charges for water supply systems in Gia Lai and Dak Nong, which were built entirely under the finance of the Vietnamese government, a water charge for the “Project for the Groundwater Development in Rural Part of Northern Provinces” carried out in three communes of Ninh Binh (Dong Phong, Qang Son, and Yen Thang), and a water charge for domestic services in Hanoi. While the water supply system in Dak Nong is designed for commercial and industrial districts of the central city and its water charge is set fairly high at 6,000VDN/m³, most charges for water supply services in other areas and cities are in the range between 1,500 and 3,000VDN/m³. For the three provinces to be covered by the Project, the estimated water charge accords more or less with the willingness to pay figures and it is therefore reasonable to set an actual water charge in this range.

Table 2.35 Comparison of Willingness to Pay in the Four Provinces and Water Charges of the Existing Facilities

Province / type of facility		Water charge (VND/ m ³)
1)	Willingness to pay in Kon Tum (K3-1)	1,593
	Willingness to pay in Gia Lai (average for five communes)	2,675
	Willingness to pay in Dak Lak (average for four communes)	2,400
2)	Water supply system in Gia Lai (self-financed)	2,000
	Water supply system in Dak Nong (self-financed)	6,000
3)	Northern Region Groundwater Development Project in Ninh Binh	2,000
4)	Hanoi (for domestic service)	2,500

(Remarks)

- 1) Estimation of water charges in the four provinces was made under the assumption that each household uses 9m³ per day.
- 2) The water supply facility in Gia Lai is Ia Rsion (G6) that was covered by the development study, and that in Dak Nong is Kien Duc (D6) that is covered by the present study.
- 3) The three communes in Ninh Binh set the same water rate.

● Equipment

2-4-5 Present Status of Well Drilling Rig Operation and Maintenance and Major Issues

The issues of present status of equipment operation and maintenance are described below.

- There is no operation and maintenance center for well drilling equipment in the Central Highlands
- Though P-CERWASS has experiences of using small equipment for geological survey, it doesn't have experiences of using well drilling equipment.

2-4-6 Operation and Maintenance System

Nine staffs are to be either recruited or transferred from within CERWASS to handle the provided well drilling equipment. It is judged that the CERWASS will finance well drilling and its maintenance, since CERWASS has the budget plan and well drilling plan from 2006 for 5 years at least.

2-4-7 Manpower Requirements and Human Resources Development Plan

2-4-7-1 Manpower Requirements for Equipment Operation and Maintenance

The 9 staff will implement the well drilling and the maintenance. The contents of manpower requirement for the operation and maintenance of equipment and well drilling are shown in Table below.

Table 2.36 Manpower Requirement

Contents of work	Manpower requirements	Numbers
Well Drilling (Including the pumping test)	Engineer (Drilling Engineer)	2
	Technician (Mechanic, Electric)	1 each
	Operator (cum driver)	5
Total		9

Table 2.37 Manpower and the Role for Operation and Maintenance of Well Drilling Equipment

Category	No. of requirement	Person in charge	Contents in charge
Inventory	1	1 engineer	Stock management and storage for drilling equipment and other accessories. Storage and arrangement of maintenance manual and parts list
Mechanic	5	1 engineer Technician (mechanic); 1 3 operators	Maintenance and repair of drilling equipment, truck and air compressor etc.. repair
Electrician	1	Technician (electric); 1	Welding
Operator	3	3 operator	Maintenance of Air compressor and generator

The operation and maintenance activities required to be carried out after implementation of the Project is shown in Table 2.38.

Table 2.38 Operation and Maintenance after Project

Category	Method of operation and maintenance
Daily maintenance in the drilling site	9 staffs in the equipment team
Accidental trouble in drilling site	CERWASS in Hanoi or P-CERWASSs will assist, if necessary
Periodical Inspection and repair of equipment	9 staffs in the equipment team
Large scale repair such as overhaul	9 staffs in the equipment team

2-4-7-2 Human Resources Development Plan

Nine staffs either newly employed or transferred internally are to receive the training in the North centre. Their skills are also expected to be strengthened through activities in the Project.

2-5 Project Cost

2-5-1 Project Cost

The total project cost is estimated as 2.26 billion JPY(2.01 billion yen for the Japanese scope of works, and 0.25 billion yen for the Vietnamese scope of works), if the project is implemented. This cost estimate is provisional and would be further examined by the Government of Japan for the approval of the Grant.

(1) Cost to be Borne by the Japanese Side

Estimated Project Cost: 2,005.1 million JPY

Item		Project Cost	
		(Approx. Million JPY)	
Facility Construction	Water Supply Facilities for 5 communes -Well, Transmission pipe, Treatment Plant, Elevated Tank, Reservoir, Distribution pipe	1,625.7	2,005.1
	Equipment Supply	200.5	
	Detailed Design, Construction / Procurement Supervision, Soft-Component	178.9	

(2) Cost to be Borne by the Vietnamese Side

Estimated Project Cost: 249.1 million JPY

Item	Project Cost (Million JPY)	
Drainage	1.7	249.1
Incoming Feeder for Wells	35.0	
Incoming Feeder for Water Treatment Plants	12.7	
Construction of Access Road	9.6	
Land Acquisition for Wells	16.6	
Land Acquisition for Water Treatment Plants	47.3	
Land Acquisition for Pipeline	11.2	
Land for Temporary Stock Yards	2.8	
Fence for Wells	6.2	
Gate for Wells	1.4	
Fence for Water Treatment Plants	5.9	
Gate for Water Treatment Plants	0.4	
Clearing of unexploded ordnance for Well Sites	0.0	
Clearing of unexploded ordnance for Water Treatment Plant Sites	0.4	
Clearing of unexploded ordnance for Pipeline Routes	24.8	
Individual House Connecting Works and Purchase of Taps	33.2	
Management Cost for IEC	1.7	
Registration fee, Insurance and Tax for truck	1.7	
Purchase of Computer and Printer	0.4	
Management Cost for PMU from CERWASS	3.3	
Banking Fee	4.4	
Sub-total	220.7	
Price Contingency (10% of sub total)	22.1	
Total	242.7	
Management Cost for PMU from P-CERWASS*1	6.4	

*1: 6% of construction cost (including drainage, incoming feeder, access road, fence, gate, individual connecting house works and taps)

Exchange rate

1US\$ = 110.54 Yen

1VND = 0.00697 Yen

2-5-2 Operation and Maintenance Cost

(1) Operation and Maintenance Cost

The calculated annual operation and maintenance cost for each province of the Project is shown in Table below. This cost includes electric power cost, chemical cost, labor cost related to operation for waterworks and repair cost (0.5% of the capital cost) for water supply facilities based on daily average water supply.

Table 2.39 Annual Operation and Maintenance Cost

Unit: VND

Province	Commune		Power Cost	Chemical Cost	Personnel Cost	Repair Cost	Total
Kon Tum	Dak Ui	K3-1	40,205,663	258,420	43,200,000	48,794,000	132,458,083
	Sub Total		40,205,663	258,420	43,200,000	48,794,000	132,458,083
Gia Lai	Kong Tang	G1	86,687,500	1,893,900	57,600,000	212,632,000	358,813,400
	Nhon Hoa	G2	193,833,250	3,207,240	64,800,000	346,415,000	608,255,490
	Sub Total		280,520,750	5,101,140	122,400,000	559,047,000	967,068,890
Dak Lak	Ea Drang	D2	374,836,750	14,748,600	86,400,000	454,720,000	930,705,350
	Ea Drong	D4-1	119,282,000	1,993,020	57,600,000	233,911,000	412,786,020
	Sub Total		494,118,750	16,741,620	144,000,000	688,631,000	1,343,491,370
Total			814,845,163	22,101,180	309,600,000	1,296,472,000	2,443,018,343

(2) Unit Price of Water Supply

The unit price of water supply is calculated using operation and maintenance cost stated above. The calculated values of unit cost are shown in Table below.

Table 2.40 Production Unit Cost

Province	Commune, WMU	Population (Persons)	Population served (Persons)	Household (Households)	Average daily supply (m ³ /day)	Accounted – for water (m ³ /day)	Annual accounted – for water (m ³ /Year)	Annual Operation and Maintenance cost (VND/Year)	Unit price of water supply (VND/m ³)
Kon Tum	Dak Ui K3-1	3,243	2,757	624	199	159	58,035	132,458,083	2,282
	Sub Total		3,243	2,757	624	199	159	58,035	132,458,083
Gia Lai	Kong Tang G1	7,996	6,797	1,738	489	391	142,715	358,813,400	2,514
	Nhon Hoa G2	13,521	11,493	2,181	827	662	241,630	608,255,490	2,517
	Sub Total		21,517	18,290	3,919	1,316	1,053	384,345	967,068,890
Dak Lak	Ea Drang D2	19,759	16,795	3,874	1,209	967	352,955	930,705,350	2,637
	Ea Drong D4-1	8,391	7,132	1,583	514	411	150,015	412,786,020	2,752
	Sub Total		28,150	23,927	5,457	1,723	1,378	502,970	1,343,491,370
Total		52,910	44,974	10,000	3,238	2,590	945,350	2,443,018,343	

(3) Ability to pay of Inhabitant

The monthly water charge per household in each commune is shown in Table below. Since the proportion of monthly charge against the monthly income is from 1.2% to 2.6%, i.e. not over 3.0%, the ability of inhabitant to pay is feasible. Therefore, the operation of waterworks implemented by WMU (or Operation Center) in each province is also feasible.

Table 2.41 The Monthly Water Charge per Household

Province	Production Unit Cost (VND/m ³)	Water consumption (m ³ /household /month)	Monthly Water Charge (VND/household /month)	Monthly Income (VND/household /month)	The proportion of monthly water charge in monthly income
Kon Tum	2,282	9	20,538	795,192	2.6 %
Gia Lai	2,516	9	22,644	1,832,069	1.2 %
Dak Lak	2,671	9	24,039	1,612,908	1.5 %

The average monthly water consumption per household: 60L/person × 4.9persons/household × 30days = 9m³

(4) O&M Cost of Well Drilling Rig

Annual operation and maintenance cost is estimated as 1% (Approx. 16,000 USD) of equipment cost except for the transportation cost and installation cost etc.

2-6 Other Relevant Issues

2-6-1 Soft-Component

(1) Background of Soft-Component

In order to improve the sanitary conditions in the rural area of Vietnam, the improvement of water supply facilities is ongoing with the targets to increase safe water supply ratio up to 85% in 2010, and furthermore, to secure 60 liter per person per day for 100% of inhabitants in 2020. As a part of this effort, the Project will support the achievement of the targets.

In the Project area, there are small-scale water supply facilities utilizing the water sources of dug wells and springs. However, most of the inhabitants have no experience of using the large-scale water supply facilities and paying the water charge. A CPC, which is supposed to be in charge of the managing the water supply facilities, has also no experience.

Therefore, the operation center in each commune is to be set up by the initiative of each CPC and it will conduct the operation and maintenance for water supply facilities. Ideally, it should be guided by P-CERWASS of each province for the technical and management fields for the operation and maintenance. In this case, WMU(Water Management Unit) will be set up as a higher organization guided by P-CERWASS and lower organization will be established in each commune.

However, considering the number of large-scale system constructed by the Project is only 1 or 2 in each province, it is too early to establish WMU. Therefore, for the time being, the operation center in each commune should be set up as the organization by self-sustenance for technical and management aspects. Its role is management of the water supply system including water charge collection. For the technical operation, consultant and contractor will conduct an on-the-job-training in the commissioning at the completion time of the Project, while for the cooperation of management, soft-component is planned.

For the sustenance of the large-scale system, cooperation and understanding of the residents, who used to have free water source such as dug well and spring etc., are essential. Considering the stable supply of safe water, support of IEC activity and establishment of operation center are assisted by the Japanese side under the Project. The summary of these activities and the methods of assistance are shown in Table 2.42

Table 2.42 Category of Technology Transfer

Field	Supporting Contents	Supporter	Recipient
Establishment of Operation & Maintenance/Development of works Environment	Establishment of Organization	Consultant (Person in charge of O&M)	Commune Operation Center (P-CERWASS, CPC)
	IEC	Consultant (Person in charge of O&M)	Commune Operation Center (Residents, CPC)
Development of Management system	Development of Management system	Consultant (Person in charge of Management)	Commune Operation Center (P-CERWASS, CPC)

CPC; Commune People's Committee

(2) Objectives of Soft-Component

The objectives of soft component of the Project are summarized as follows:

1) Establishment of Organization

- To establish an operation center in each commune and sustainable system of operation and maintenance
- To prepare a manual for operation and maintenance
- To formulate a training plan for staff

2) IEC (Information, Education and Communication)

Through the IEC activity, the inhabitants or users will be expected to have the following:

- To deepen the understanding for the public health and sanitation.
- To understand the outline of water supply facilities
- To deepen the understanding of the cost of operation and maintenance of the facilities.
- To heighten the will of residents' cooperation for the operation and maintenance of the facilities.

3) Development of Management System

- To develop a sustainable management system
 - To estimate a number of users
 - To make a customers ledger
 - To estimate an amount of water consumption
 - To estimate an expenditure (electric power cost, chemical cost and labour cost) based on the estimation of the amount of water consumption
 - To determine and revise water tariff meeting the expenditure
- To acquire a knowledge of water meter reading
- To acquire methods of data collection and updating and operate the database of water charge collection

(3) Expected Output of Soft-Component

Through the execution of soft component, the expected result and its content in each field are summarized in Table 2.43.

Table 2.43 The Result of Soft-Component

Field	Contents	Results
Establishment of Organization	<ol style="list-style-type: none"> 1) To establish operation center through the joint meeting among the related agencies such as P-CERWASS, CPC, etc. 2) To establish the communication channel by completing the organization chart, table describing responsibility of each position and communication network 3) To modify the manual for management of operation & maintenance prepared in the JICA Development Study by adding in accordance with the actual works, together with the persons concerned. 4) To formulate the plans of lecture & training in accordance with the personnel and actual work capacity of each commune in each province through the conference with the persons concerned. 	<ul style="list-style-type: none"> - An operation center is established in each commune. -The role, organization chart and method of management and operation are codified and published in and out of organization. -The role and responsibility of each staff are clarified. -The manual for management of operation and maintenance is prepared. -The contents of lecture & training for each staff are formulated.
IEC	<ol style="list-style-type: none"> 1) Concerning the water supply, public health and sanitation, the enlightenment guidance is carried out by using the teaching materials which are simple and easy to understand. 2) To explain to the inhabitants the main features of water supply facilities planned in each commune by using the data, etc. 3) To have the understanding of inhabitants about the cost of operation and maintenance for the facilities by showing them some concrete figures. 4) To promote the voluntary cooperation of inhabitants through the explanation of the system of management for operation and maintenance. 	<ul style="list-style-type: none"> -(The inhabitants) understand the safety of water supply. -The public health and sanitation is deeply understood by the inhabitants. -The outline of water supply facilities is understood. -The cost of operation and maintenance of the facilities is understood. -The will of cooperation for the operation and maintenance of the facilities is raised.
Development of management system	<ol style="list-style-type: none"> 1) To develop sustainable management system 2) To lecture the scheduling of water charge collection, the water meter reading and the method of calculation of collected water charge. 3) To carry out OJT for the users' data collection and the data input at the commencement of the operation. 4) To carry out OJT for the application based on the data mentioned above and the data renewal. 5) To prepare the invoice and receipt by using the database 	<ul style="list-style-type: none"> -Staff of the operation center is able to prepare sound budget and water charge to meet expenditures such as electric power cost, chemical cost and labor cost. - Staff of the operation center is able to read water meters - Staff of the operation center is able to collect data and input them to a ledger of the water charge collection system - Staff of the operation center is able to manage the water charge collection system - Staff of the operation center is able to renew data in the ledger of water charge collection system

Field	Contents	Results
		- Staff of the operation center is able to collect the water charge by using the water charge collection system

(4) Verification of Output

Upon completion of the soft component activity, a consultant will evaluate its result and will summarize it as a “soft-component completion report”. The report will be circulated to both CERWASS and JICA. Table below shows the expected results and corresponding evaluation items.

Table 2.44 Achieved Result

Field	Result	Parameters of Confirmation on Achievement Level
Establishment of Organization	-Operation center is established in each commune.	- Are staffs for the operation center in each commune selected?
	-The role, organization chart and method of management and operation are codified and published in and out of organization. -The role and responsibility of each staff are clarified.	- Is the regulation of role, organization chart and the management method codified? - Is regulation understood by commune operation center and P-CERWASS? - Is regulation open to resident?
	-The manual for management of operation and maintenance is prepared.	- Is the manual of operation & maintenance modified and added in accordance with the actual works and the conditions of each commune?
	-The contents of lecture & training for each staff are formulated.	- Are the contents of lecture and training in accordance with the capacity of each staff already decided through the conference with the persons concerned. - Are the budgets for lecture and training from the related agencies already secured.
IEC	-(The inhabitants) understand the safety and needs of water supply	- Did (the inhabitants) enjoy safe and stable water supply. (questionnaire survey will be conducted to confirm the above. The same is applied in the following items)
	-The public health and sanitation is deeply understood by the inhabitants.	- The inhabitants understand relationship of water-borne disease and water supply system. - The inhabitants understand infiltration of sludge and wastewater pollute shallow well water - The inhabitants understand improper solid waste dumping will pollute shallow well water..
	-The outline of water supply facilities is understood.	- The outline of water supply facilities to be constructed (method of water treatment, route of distribution pipeline network, etc.) is understood ? - The knowledge of groundwater as the water source is acquired ?
	- The cost of operation and maintenance of the facilities is deeply understood.	- To be able to understand the outline of costs for operation & maintenance such as chemicals, personnel expenditure, etc. and to confirm the willingness to pay for the water charge.

Field	Result	Parameters of Confirmation on Achievement Level
	-The will of cooperation for the operation and maintenance of the facilities is raised.	- To be able to confirm the cooperation will of inhabitants for operation & maintenance.
Development of management system	-Staff of the operation center is able to prepare sound budget and water charge to meet expenditures such as electric power cost, chemical cost and labor cost.	- To be able to calculate the income through the database. - To be able to calculate electric power cost and chemical cost etc.
	-Staff of the operation center is able to read water meters.	- Number of metered houses and metered positions are already confirmed. - To be able to read the water meter and calculate the water volume consumed in the month of meter reading. - To be able to prevent inadequate readings - To be able to input read consumed water volume into the form
	-Staff of the operation center is able to collect data and input them to a ledger of the water charge collection system.	- To be able to input read consumed water volume into the ledger.
	-Staff of the operation center is able to manage the water charge collection system.	- To be able to collect the water charge by utilizing the database of water charge collection.
	-Staffs of the operation center is able to renew data in the ledger of water charge collection system.	- To be able to renew correctly the data such as the newly connected and disconnected households, change of user's data, etc.
	-Staff of the operation center is able to collect the water charge by using water charge collection system.	- To be able to issue the bill by using water charge collection system. - To be able to collect the water charge and issue receipt by using water charge collection system.

(5) Activity of Soft-Component (Input)

Table 2.45 and Table 2.46 show schedule for the soft component activities.

In order to establish the organizations, three communes will be selected from those in the northern project. Operation and maintenance of organizations in the selected communes will be studied and the results will be reflected to the establishment of operation and maintenance system in the five communes of this project.

In establishment of organization system, the meeting with each commune will be held following the seminar with P-CERWASS. In the first meeting, consultation will be made with CPC and P-CERWASS concerning employment of staff and settlement of employment condition. In the second meeting, the issues will cover explanation of each job and its allocation

to the staff that will be employed in operation center in each commune,. In the last meeting, organization, policy, regulations and communication channel between CPC and P-CERWASS will be confirmed together with P-CERWASS.

For IEC, explanation in each commune will be conducted 3 times after development of the IEC plan. In the first meeting, necessity of water supply facility so as to keep good hygiene condition will be explained. In the second meeting, outline of water supply facilities and requirement of water charge collection will be explained. In the last meeting, based on the two times explanations, after the confirmation of willingness to cooperate with waterworks and understanding of hygiene, the inhabitants are encouraged to connect with the water supply system.

For development of management system, after P-CERWASS recognize importance of management system, each commune operation center will be trained. On the first day, the staffs in commune operation center will be taught about the importance of water charge collection and of budget preparation. From the second day onward for 10 days, water charge ledger will be developed. Finally for the three days, the ledger will be created using an actual connected households and it will be simulated for its completion.

Table 2.45 The Plan for the Soft-Component Activity (Phase 1)

Area	Items	Require No.	Day	Contents of Activity	Actual Working day				Calendar Working day				
					Experts of O&M system/Development of Waterworks Environment		Experts of O&M system/Development of Waterworks Environment		Experts of O&M system/Development of Waterworks Environment		Experts of O&M system/Development of Waterworks Environment		
					Japanese Resident	3.0	Japanese Resident	3.0	Japanese Resident	4.0	Japanese Resident	4.0	Japanese Resident
(1) Establishment of Organization	Review of Northern Project	3 communes x 1 day	3	Understanding of WMU in Northern Project (3 Communes of 3 Provinces)	3.0	3.0	3.0	3.0	4.0	4.0	4.0	0.0	0.0
	Seminar for P-CERWASS (Daik Lak Province)	1 time x 1 day	1	Decision of the staff selection for the operation center Decision of the schedule regarding the operation center establishment Confirmation of the manual for O&M Planning of the training for participant	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0
	Meeting with each commune and P-CERWASS (Establishment and Selection of a suitable person etc.)	2 Communes x 1 day	2	Explanation of each duty position Decision of the staff selection in commune operation center Decision of the condition of employment for person in charge Confirmation of contents in the manual for O&M	2.0	2.0	2.0	2.0	3.0	3.0	3.0	0.0	0.0
	Guidance for operation center in each commune (Division of roles etc.)	2 Communes x 1 day	2	Explanation and Confirmation of the description of work for each staff Business guidance by simulation Lecture for monitoring implementation Understanding of each staff's capacity, Setup of the training contents according to capacity	2.0	2.0	2.0	2.0	3.0	3.0	3.0	0.0	0.0
	Meeting with each commune and P-CERWASS (Confirmation etc.)	2 Communes x 1 day	2	Creation of the conclusive organization chart, O&M system network and rule etc. Confirmation of the communication channel in case of trouble Decision of training and training contents Question and Answer	2.0	2.0	2.0	2.0	3.0	3.0	3.0	0.0	0.0
	Seminar for P-CERWASS (Daik Lak Province)	1 time x 1 day	1	Confirmation of the IEC activity schedule, contents and method. Understanding of present conditions and problems in each commune Confirmation of the division of rules for person in charge Agreement of the IEC activity after completion of facility	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0
	Resident explanation meeting in each commune (The system of water supply system etc.)	2 Communes x 1 day	2	Lecture of the typical water treatment system and its advantage Explanation of the groundwater utilization Explanation of the details of water supply facility in each commune Recognition enhancement of the O&M cost (Chemical, Labor cost etc.)	2.0	2.0	2.0	2.0	3.0	3.0	3.0	0.0	0.0
	Resident explanation meeting in each commune	2 Communes x 1 day	2	Explanation of importance of safe drinking water Recognition enhancement of the waterborne disease	2.0	2.0	2.0	2.0	3.0	3.0	3.0	0.0	0.0

Table 2.46 The Plan for the Soft-Component Activity (Phase 2)

Area	Items	Require No.	Day	Contents of Activity	Actual Working day				Calendar Working day				
					Experts of O&M system/Development of Waterworks Environment		Experts Management system		Experts of O&M system/Development of Waterworks Environment		Experts Management system		
					Japanese Resident	2.0	2.0	Japanese Resident	Japanese Resident	3.0	3.0	Japanese Resident	Japanese Resident
(1) Establishment of Organization	Seminar for P-CERWASS (Kon Tum and Gia Lai Province)	2 times x 1 day	2	Decision of the staff selection for the operation center	2.0	2.0	3.0	3.0	0.0	0.0	0.0	0.0	
				Decision of the schedule regarding the operation center establishment									
				Confirmation of the manual for O&M									
	Meeting with each commune and P-CERWASS (Establishment and Selection of a suitable person etc.)	3 Communes x 1 day	3	Planning of the training for participant	3.0	3.0	5.0	5.0	0.0	0.0	0.0	0.0	
				Explanation of each duty position									
				Decision of the staff selection in commune operation center									
	Guidance for operation center in each commune (Division of roles etc.)	3 Communes x 1 day	3	Decision of the condition of employment for person in charge	3.0	3.0	4.0	4.0	0.0	0.0	0.0	0.0	
				Confirmation of contents in the manual for O&M									
				Explanation and Confirmation of the description of work for each staff									
				Business guidance by simulation									
Meeting with each commune and P-CERWASS (Confirmation etc.)	3 Communes x 1 day	3	Lecture for monitoring implementation	3.0	3.0	4.0	4.0	0.0	0.0	0.0	0.0		
			Understanding of each staff's capacity, Setup of the training contents according to capacity										
			Creation of the conclusive organization chart, O&M system network and rule etc.										
			Confirmation of the communication channel in case of trouble										
(2) IEC	Seminar for P-CERWASS (Kon Tum and Gia Lai Province)	2 times x 1 day	2	Decision of training and training contents	2.0	2.0	3.0	3.0	0.0	0.0	0.0	0.0	
				Question and Answer									
				Confirmation of the IEC activity schedule, contents and method.									
	Resident explanation meeting in each commune (The system of water supply system etc.)	3 Communes x 1 day	3	Understanding of present conditions and problems in each commune	3.0	3.0	4.0	4.0	0.0	0.0	0.0	0.0	
				Confirmation of the division of rules for person in charge									
				Agreement of the IEC activity after completion of facility									
				Lecture of the typical water treatment system and its advantage									
	Resident explanation meeting in each commune (Hygiene education)	3 Communes x 1 day	3	Explanation of the details of water supply facility in each commune	3.0	3.0	4.0	4.0	0.0	0.0	0.0	0.0	
				Explanation of the groundwater utilization									
				Recognition enhancement of the O&M cost (Chemical, Labor cost etc.)									
		3 Communes x 1 day	3	Explanation of importance of safe drinking water	3.0	3.0	4.0	4.0	0.0	0.0	0.0	0.0	
				Recognition enhancement of the waterborne disease									
				Lecture of the water pollution caused by human waste and sewage water									

Area	Items	Require No.	Day	Contents of Activity	Actual Working day				Calendar Working day										
					Experts of O&M system/Development of Waterworks Environment		Experts Management system		Experts of system/Development of Waterworks Environment		Experts Management system								
					Japanese	Resident	Japanese	Resident	Japanese	Resident	Japanese	Resident							
				Discussion of the treatment for human waste and sewage water Discussion of waste disposal															
	Workshop in each commune (Confirmation etc.)	3 Communes × 1 day	3	Confirmation of willingness to cooperation for O&M of water supply facilities Check of understanding about water supply Check of understanding about health and sanitation Question and answer	3.0					3.0				4.0		4.0	0.0	0.0	
(3) Development of Management System	Seminar for P-CERWASS (Kon Tum and Gia Lai Province)	2 times × 1 day	2	Explanation of importance of water charge collection Explanation of the brief of database Confirmation of consistency of other areas Recommendation of installation to other areas Explanation and Generalization of the supporting result			2.0				2.0			0.0		0.0	3.0	3.0	
	Guidance for operation center in each commune (Creation of the system of water charge collection)	3 Communes × 1 day	3	Explanation of importance of water charge collection Explanation of the brief of water charge ledger program (macro function) Creation of water charge ledger program (macro function) Checking of operations for water charge ledger program (macro function) Guidance of operation for water charge ledger program (macro function)			3.0				3.0			0.0		0.0	4.0	4.0	
	Guidance for operation center in each commune (Creation of data and OJT)	3 Communes × 10 days	30	Collection and arrangement of information about customs and water consumption etc. Input data Test installation of practice menu Response for program error			15.0				30.0			0.0		0.0	21.0	42.0	
	Guidance for operation center in each commune (Confirmation etc.)	3 Communes × 2 days	6	Confirmation of data Simulation of practice menu (Setting of water charge balanced with expenditure) Confirmation of achievement of budget etc.			6.0				6.0			0.0		0.0	8.0	8.0	
														Sub-Total (M/day)		31.0	31.0	36.0	57.0
														Sub-Total (M/M)		1.03	1.03	1.20	1.90
														Total (M/M)			2.23	2.23	2.93

(6) Manpower Requirement

1) IEC and Organization Establishment

A Japanese consultant (expert of management system for operation & maintenance/ organization set-up) is to be assigned to do the soft component of the IEC and organization set up. C-CERWASS and P-CERWASS are requested to work together with a Japanese consultant.

Since the communication in English language is difficult in the communes, Vietnamese interpreters will be appointed. Furthermore, in the communes where the settlements of minority ethnic groups are included in the target area, the interpreters between Vietnamese and the language of minority ethnic group are to be hired according to the necessity.

In Dak Lak and Dak Nong Provinces, DANIDA is supporting the IEC activity of P-CERWASS although it is limited within the target areas of DANIDA projects. Therefore, in order to avoid the confusion of inhabitants and staff of P-CERWASS due to the difference of the activity technique between Japan and DANIDA, the IEC activity will be conducted respecting the technique of DANIDA.

2) Development of Management System

A Japanese consultant (expert for water management system) will carry out the soft component activities of preparation of budget, water charging ledger system etc. He or she will also develop a water charge collection method and construct a database of water charge collection. Data entry operator will assist to prepare creation of the database of water charge collection and will receive OJT of the database construction. For that purpose, computers are to be purchased and provided to each commune by the Vietnamese side. The database on water charge collection is required for correctly and effectively understanding the collection condition of households in each communes mentioned below. Understanding the data on water charge collection by manual is difficult due to typographical errors and omissions.

Table 2.47 Number of households in each communes

	Commune	No. of households
K3-1	Dak Ui	624
G1	Kong Tang	1738
G2	Nhon Hoa	2181
D2	Ea Drang	3874
D4-1	Ea Drong	1583
Total		10,000

(7) Implementation Schedule

The implementation schedule for the soft components under the Project is shown in Table 2.48.

(8) Result of Soft Component

At the end of the soft component activities, “Completion Report of Soft Component” will be prepared, based on the evaluation and analysis. The lists of results included in the Report are shown in Table 2.49.

Table 2.49 List of the Soft-Component Result

Area	Result
Establishment of Organization	- Rules (Organization Chart, Network sheet) - Job Responsibility sheet - Operation and Maintenance manual (Final edition) - Minutes
IEC	- Workshop records, Minutes
Water Charge Collection	- Software for Water charge collection database and its manual - Minutes - Daily record for OJT

(9) Estimated Cost for Soft Component

The estimated cost for soft component is as follows:

Phase 1:	JPY 4,955,000
Phase 2:	JPY 6,704,000
<hr/>	
Total	JPY 11,659,000

(10) Responsibility of Executing Agency in Vietnam

Most of the communes in the Project Area have little experience of the water supply facilities and, although P-CERWASSs are the direct supervising agencies, they also do not have sufficient experience in this respect. A public awareness activity for the ICE activities is conducted at the commencement of water supply operation. However, P-CERWASSs need to continue the public awareness activities so as to gain full effects. The database needs to be maintained and renewed periodically so as to utilize the database effectively by the Vietnamese side.

Chapter 3 Project Evaluation and Recommendations

Chapter 3 Project Evaluation and Recommendations

3-1 Project Effect

The Project has been proposed to make potable water available to major part of the population in the Project area. The proposed project (including components to be implemented by the Vietnamese side) along with their current conditions and effects are summarized as shown in Table below.

Present Conditions and Problems	Counter Measures by Project	Effects of Project and Level of Improvement
<p>1. Shortage of Served Water Volume</p> <p>In the Central Highlands area, non-pressured groundwater from sources such as dug well and shallow well are mainly used and the water shortage frequently takes place due to the dry up in the drying season.</p>	<p>To construct the water supply facilities with artesian groundwater (deep well, sufficient water volume and good water quality) as the water source, which can be used on sustainable basis with the safe water quality.</p> <p>To construct the water supply system serving for 24 hours and serving house connections.</p> <p>Service population: 44,974 persons Service ratio in the target area: 85%</p>	<p>In the Project area, the required service water volume of 60 liter per person per day will be secured stably for the planned service population of 44,974 persons in 2010. (Increase in population served by water supply as percent of total population is 1.4%)</p>
<p>2. Deterioration of Groundwater Quality</p> <p>Due to the contamination of non-pressured groundwater by infiltration from surface drainage, sewage, etc., the water-borne disease ratio is getting higher among the inhabitants who use the groundwater mentioned above.</p>	<p>Same as above</p>	<p>The water born disease ratio will be decreased by the implementation of the water supply service having safe water quality.</p>
<p>3. Use of Boring Machines for Well Drilling</p> <p>The well drilling is ineffective due to the utilization of core boring machine. Moreover, these boring machines are quite old. Due to these reasons, the construction of deep wells using these machines takes longer period of time.</p>	<p>One set of well drilling rig (drilling depth 200m) is to be supplied and 60 deep wells are planned to be drilled using this machine.</p>	<p>The water supply facilities of the large scale (each system serving about 10,000 persons) will be implemented effectively and, accordingly, it will contribute to the National Target of NRWSS. (Increase in population served by water supply as percent of total population is 6.3% including 1.4% mentioned above)</p>

3-2 Recommendations

In order to execute the Project effectively, and to manage the sustainable operation and maintenance of the constructed facilities, there are certain tasks to be arranged and undertaken by CERWASS and P-CERWASS. These tasks and the proposals for them are as follows:

(1) Execution of Construction Works Assigned under Responsibility of Vietnamese Side

In order to execute the Project smoothly and to achieve its target as desired, CERWASS and P-CERWASS shall essentially execute the part of activities under the responsibility of Vietnamese side such as the land acquisition for the sites of Project, the land preparation works, the electrical works for incoming power cables, clearing unexploded ordnance, establishment of the equipment team in the central highlands, etc., by securing the fund required for these construction works without any delay.

The service pipeline installation works and facilitating water supply connection to each individual household under the responsibility of Vietnamese side, should be executed smoothly and timely, at the same time, the application for connection from inhabitants, its acceptance, collection of connection fee, etc., shall be carried out. In order to execute these works smoothly, "Operation Center" shall be established in each commune under P-CERWASS.

(2) Proper Management of Water Supply Service

It is essential for the Government of Vietnam and the People's Committee of each Province to establish reasonable water tariff by considering carefully the balance between the capacity of inhabitants to pay and the cost required for the proper operation and maintenance of water supply facilities.

For the purpose mentioned above, the operation center of equipment to be established shall be in charge of the decision on the overall management policy, the judgment of approval matters, the negotiation with the related governmental offices, etc. this operation center shall be in charge of the actual works of the management for the operation and maintenance. By executing these works adequately, it will become possible that the income is secured by the water charge collection and, moreover, the water supply service is managed on the basis of the self-supporting financial system.

(3) Proper Operation and Maintenance of Water Supply Facilities

In order to secure the stable water supply volume, the conservation of water source and the

proper operation & maintenance for the conveyance, distribution and service pipelines are essential. For the conservation of water source, it is necessary to maintain pumping up of water volume below the well safety yield. For the conveyance, distribution and service pipelines, it is necessary to carry out leakage prevention measures properly and an immediate repair if the pipe damage occurs.

On the other hand, in order to secure the safe water quality, the water quality control from the water source to the water supply service facilities is important. Especially, the conservation of the water source and the proper operation & maintenance of the water treatment facilities are to be pointed out for the safe water quality.

For the conservation of the water source, it is necessary to promote the public awareness among the inhabitants for the purpose of preventing the development activities and the contamination around the water source area. For the water treatment facilities, it is necessary to carry out appropriate operation and maintenance of the mechanical equipment such as the chlorine injection equipment, etc. and also the facilities and accessories such as sand filter, the chemicals, etc.

(4) Groundwater Monitoring with respect to Water Quality and Lowering of Water Level

In order to enable continuous utilization of the new constructed wells in the Project, it is necessary to secure the monitoring system of wells. The monitoring is required with respect to the quality of water withdrawn from deep aquifer and the lowering of watertable due to pumping. The Ministry of Natural Resources and Environment is responsible for the monitoring. The CERWASS needs to confirm that the Ministry will continue the monitoring.

(5) Agreement of Land Owners on Land Acquisition

Some of the lands where water supply facilities are to be constructed are private lands. Therefore, land acquisition process should be executed according to the laws of Vietnam. Although the acquisition of the private land is confirmed during the study to be feasible through CPC, it is necessary to reconfirm it from landowner and get their agreement on land acquisition.