No.

MINISTRY OF WORKS AND HOUSING
THE REPUBLIC OF GHANA

BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
RURAL WATER SUPPLY (PHASE-IV)
IN
THE REPUBLIC OF GHANA

DECEMBER 2000

JAPAN INTERNATIONAL COOPERATION AGENCY
SANYU CONSULTANTS INC.

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PREFACE

In response to a request from the Government of Ghana the Government of Japan decided to conduct a basic design study on the Project for Rural Water Supply Phase-IV and entrusted the study to the Japan International Cooperation Agency (JICA).

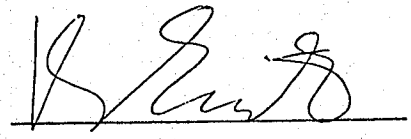
JICA sent to the Republic of Ghana a study team from February 26 to May 10, 2000.

The team held discussions with the officials concerned of the Government of Ghana, and conducted a field study at the study area. After the team returned to Japan, further studies were made. Then, two missions were sent to the Republic of Ghana in order to discuss a draft and a draft-final basic design, and as these results, the present report was finalized.

I hope that this report will contribute to the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Ghana for their close cooperation extended to the teams.

December 2000



Kunihiko Saito

President

Japan International Cooperation Agency

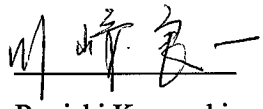
Letter of Transmittal

We are pleased to submit to you the basic design study report on the Project for Rural Water Supply Phase-IV in the Republic of Ghana.

This study was conducted by Sanyu Consultants Inc., under a contract to JICA, during the period from February 21, 2000 to November 5, 2000. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Ghana and formulated the most appropriate basic design for the project under Japan's grant aid scheme.

Finally, we hope that this will contribute to further promotion of the project.

Very truly yours,



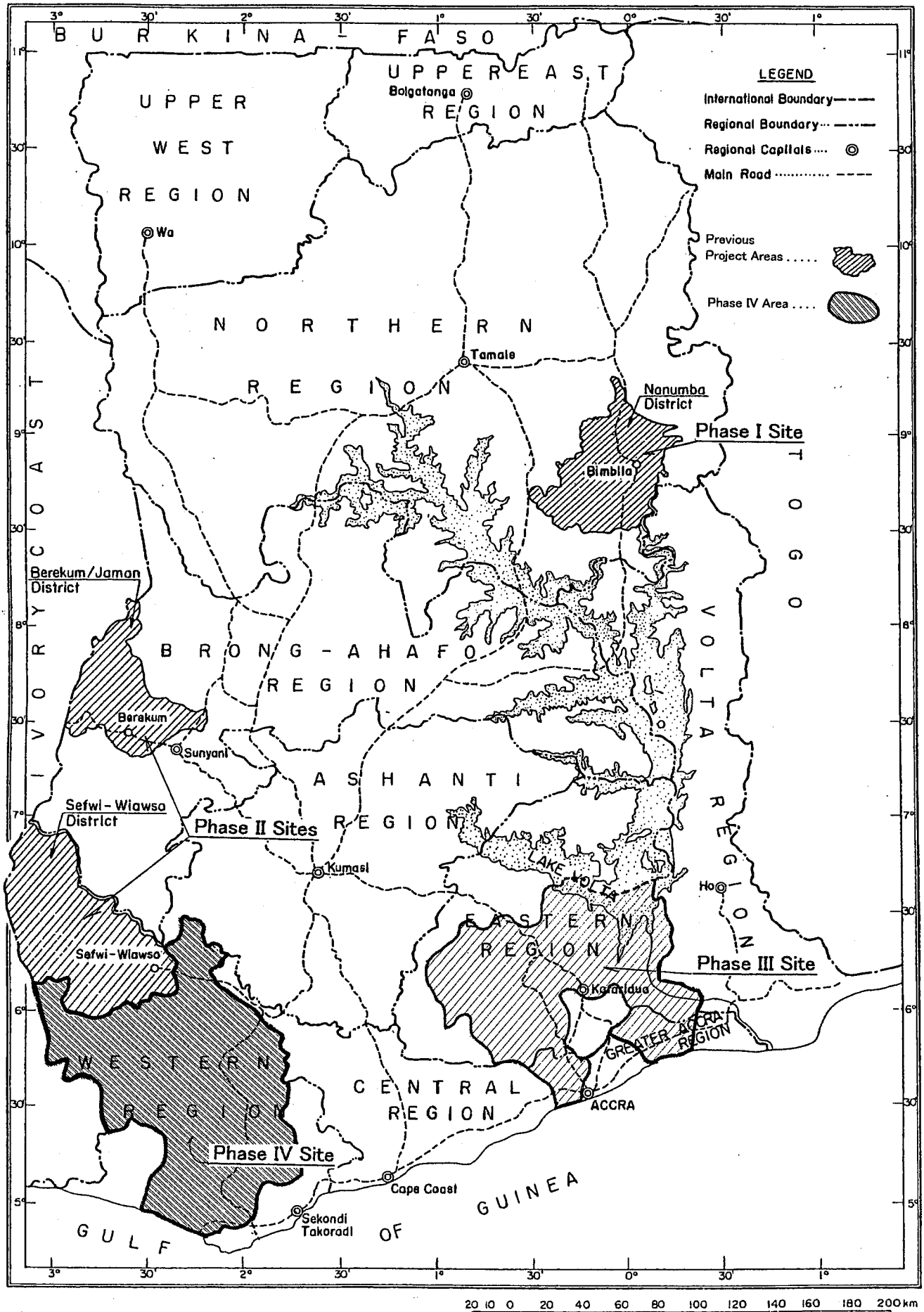
Ryoichi Kawasaki

Project Manager
Basic Design Study Team on
The Project for Rural Water Supply Phase-IV

Sanyu Consultants Inc.

プロジェクト地区位置図

LOCATION MAP OF THE PROJECT AREAS



Abbreviation

AfW : Agence Francais de Development
BHN : Basic Human Needs
CIDA : Canadian International Development Agency
COM : Community Ownership and Management
CWSA : Community Water and Sanitation Agency
CWSD : Community Water and Sanitation Division
CWSP : Community Water and Sanitation Programme
DA : District Assembly
DANIDA: Danish International Development Agency
DFR : Department of Feeder Road
DUR : Department of Urban Road
DWST : District Water and Sanitation Team
ECG : Electric Company of Ghana
ERP : Economic Recovery Programme
EU : European Union
GOG : Government of Ghana
GWSC : Ghana Water and Sewerage Corporation
IDA : International Development Agency
JICA : Japan International Cooperation Agency
KfW : Kreditanstalt fur Wiederaufbau
MoRT : Ministry of Road and Transport
MoWH : Ministry of Works and Housing
NDC : National Democratic Congress
NGO : Non Government Organization
PNDC : Provisional National Defense Council
PO : Partner Organization
RWST : Regional Water and Sanitation Team
SBDU : Small Business Development Unit
SIP : Strategic Investment Plan
UNICEF : United Nation International Children's Education Fund
VLF : Very Low Frequency
VLOM : Village Level Operation and Maintenance
VLOMM: Village Level Operation and Management of Maintenance
WATSAN: Water and Sanitation (Committee)
WHO : World Health Organization
WSDB : Water and Sanitation Development Board

TABLE OF THE CONTENTS

Chapter 1. BACKGROUND OF THE PROJECT

In the middle of 80s, the Government of Ghana (GOG) formulated the "National Economic Recovery Program (ERP, term-1: 1983-86, term-2: 1987-91)" in order to strive for the improvement of social infrastructure and for the diminution of local socio-economic disparities, as well as the enhancement of national economic activities. The Ghana Water and Sewerage Corporation (GWSC) which was responsible for the water supply and sanitation development throughout the country, under the Ministry of Works and Housing (MoWH), formulated the "Five-year Rehabilitation and Development Programme (1985-89)" under the ERP, and launched the "6,000 Well Drilling Project". The Project for Rural Water Supply Phase-I and II under Japan's grant aid were implemented as sub-projects of this.

In 1993, MoWH formulated the "Strategic Investment Plan (SIP: 1994-09)" based on the review of said 6,000-well project that was considerably delaying in its progress. The 93's SIP aimed for 80% of rural water coverage with 20 lcd of standard water consumption, targeting rural communities and small towns by the year of 2009. Major contents of the plan were, (a) provision of 25,000 hand dug-wells, (b) drilling of 16,000 boreholes, (c) construction of 500 sites of pipe-borne water systems, and (d) provision of other 1,000 sites of water resources. The Rural Water Supply Project Phase-III by Japanese cooperation was requested and conducted based on the SIP, in the Eastern and the Greater Accra Regions where had rather low water coverage rate at the time.

The 93's SIP was, however, formulated basically on the assumptions, and its progress was quite irregular locally. Therefore, in the low development areas, many rural inhabitants are still suffered from the water-borne diseases such as Guinea-worm or schistosomiasis, etc. While, the housewives who owe an important role in the rural economic activities must spend precious day time for water fetching. Children are also mobilized for water fetching, and thus, many schoolboys and girls easily lose the chance to go to school, especially in the dry seasons. Under the condition, the Government of Ghana formulated a new national development program in the water and sanitation sector, namely the "Community Water and Sanitation Programme (CWSP: 1994-09)". The program is the most basic plan for all of the activities in this sector, aiming to improve the rural water and sanitation coverage. The CWSP was taken into "Ghana – VISION 2020", the national development program formulated in 1996, and ranked at high priority. The request on this Basic Design Study was based on CWSP, targeting to the Western Region where the rural water coverage was still kept at low level.

Chapter 2. CONTENTS OF THE PROJECT

2-1. Objectives of the Project

The Project is the fourth phase of the "Rural Water Supply Project in Ghana" which has been conducted under Japan's grant aid since 1986. The Phase-IV Project is planned out under CWSP targeting to five Districts in the Western Region.

Although CWSP is aiming to contribute to the improvement of national economy through a rural water supply and a sanitation development, the direct objectives of the Project are the following five items:

(a) to provide access to adequate and potable water,
(b) to eradicate water borne diseases,
(c) to increase economic output of the rural population through income generating activities,
(d) to improve upon the general health being of the rural population, and
(e) to ensure the sustainability of the facilities through a community ownership and management approach.

2-2. Basic Concept of the Project

The contents of the requested project were, (a) to construct 1,200 boreholes equipped with hand-pump at around 750 communities with population from 200 to 2000, (b) to construct 50 mechanized borehole systems with solar powered pump in the communities with population of more than 2,000 and less than 5,000, and (c) to perform animation and siting activities concerned, in the whole Western Region.

Through the field investigation and discussions with Ghanaian officials concerned, the requested contents of the project was finally modified as follows:

(a) Construction of proper number of boreholes equipped with hand-pump in five Districts in the Western Region, depending upon the results of the Study. The target communities for the Study shall be 340 communities,
(b) Construction of proper number of Level-2 water supply facility(s) with mechanized pump system in the Western Region, and
(c) A part of animation activities in the target communities.

When the original request was issued, the counterpart organization of Ghana was the GWSC, however, it was replaced with the "Community Water and Sanitation Agency (CWSA)" newly established to manage CWSP since its establishment, which was the former Community Water and Sanitation Division (CWSD) of the GWSC.

In Japan, the results of field investigation were examined comprehensively, and the basic concept of the Project was finally formulated. The concept of the Project is to provide the following cooperation under Japan's grant aid,

1. to construct 285 boreholes equipped with hand-pump (Ldevl-1 facilities),
2. to construct 5 pipe-borne water supply systems (Level-2 facilities),
3. to cooperate on animation activity, and
4. to provide any support to District Water and Sanitation Team (DWST), if necessary.

2-3. Basic Design

2-3-1. Design Concept

1) Policies on natural conditions

a. Rainy season

The project area has considerably long rainy season with two rainfall peaks. The major one between them begins in April and ends in July. The small one is from September to October. Shutdown period when most of the field works shall be stopped is, however, set at only June. In the other months within the rainy season, workable days shall be estimated based on the rainfall data for the latest ten years.

b. Well location and structure

Siting work with hydrogeological investigation shall be conducted in the implementation period in advance of the drilling works and the borehole site shall be selected through discussion between the community and the Consultants based on the results of such investigation.

Well structure for hand-pump well shall be same with the CWSA standard but the well depth shall be of 35m min., 80m max., and 55m in an average in accordance with the results of geophysical prospecting.

c. Criteria on successful borehole

Criteria on successful borehole are (1) more than 13.0 lit/min of yield and (2) enough high water quality prescribed by CWSA as shown below:

Item	CWSA Index	WHO Index
Turbidity	less than 25°	-
Color	less than 50°	less than 50°
COD	less than 10 ppm	less than 10 ppm
pH	6.5 – 9.2	(6.5 – 9.2)
NO_3	less than 45 ppm	less than 40 ppm (80)
F	less than 1.5 ppm	less than 1.0 ppm (1.5)
Fe	less than 1.0 ppm	less than 0.3 ppm (1.0)
Mn	less than 0.5 ppm	less than 0.1 ppm (0.5)
Zn	less than 5.0 ppm	less than 5.0 ppm (15.0)
T. Hardness	less than 500 ppm	100 - 500

d. Iron-removal facility

A borehole which yields more than 13.0 lit/min but the water yielded from the borehole contains Fe more than the CWSA's index shall be installed an iron-removal facility and counted as a successful borehole (exceeding 1.0 but less than 3.0 ppm of the Fe contents). The number of boreholes needed such iron-removal facility is estimated as 14, approximately 5% of the planed construction number of borehole facilities, from the results of field water quality tests.

e. Successful rate of drilling

Successful rate of drilling for hand-pump equipped well is to be 75%, based on the examination on previous projects conducted in the Western Region, and the reviewing of the previous JICA projects in Ghana.

2) Policy on social conditions

a. Definition of target communities for Level-2 facility

In accordance with the official request from the Government of Ghana, the target communities for Level-1 facility (Hand-pump well) are the rural communities with population from 200 to 2,000, and the target communities for Level-2 facility (Solar powered system at original) are small towns with population more than 2,000 and less than 5,000. However, there are big communities with more than 2,000, sometime more than 5,000 of population. Thus, only the population cannot be the index to separate small town from the other communities.

The target communities for Level-2 facility, even though rather small-scale towns such as Kikam or Suburi having populations from 3,000 to 4,000, have a concentrating town center, several primary schools and Junior Secondary Schools, a hospital or clinic, and a market periodically held. That means, they were traditionally taking a role of socio-economic center of a certain local zone, regardless of the population. By the viewpoint, the small town as a target of Level-2 facility is categorized that the community providing all conditions listed below:

- Having more than 2,000 of population,
- Having concentrated town center,
- Having some primary schools and junior secondary school, or a senior secondary school,
- Having a hospital or clinic,
- Having a market regularly held,

b. Priority of the Level-1 facility

Priority order of the borehole facility to be constructed shall be examined from the following criteria:

1. The village which has no proper water supply facility has the first priority.
2. The village which has one water supply facility but whose population is more than 1,200 right now has the second priority.
3. The village which has two water supply facilities but whose population is more than 1,000, or having one facility and more than 1,000 of population, has the third priority.
4. The village having more than 2,000 of population has the forth priority.
5. The villages having the first or the second priority shall be further classified into A and B groups through the conditions of population, availability of groundwater, existence of WATSAN Committee, access, and so forth.
6. Even though having high priority through the examination mentioned above, the villages which has hydrogeological risks such as small yield, high iron contents, or poisonous groundwater, shall be reduced its priority one or two ranks.

Based on the ranking criteria, listed above, the communities in the target area can be arranged as follows:

The target communities in the district

Aowin Suaman	56 communities
Bibiani A. Bekwai	66 communities
Nzima East	47 communities
Wassa Amenfi	77 communities
Wassa West	76 communities
Total	322 communities

Number of boreholes at priority ranking

The first (A)	187 holes	
The first (B)	31 holes	(218 holes)
The second (A)	43 holes	
The second (B)	24 holes	(285 holes)
The third	51 holes	(336 holes)
The fourth	34 holes	
Total	370 holes	

At the Project, total 285 borehole facilities in the communities ranked more than the Second (B), under the most severe water supply condition with only one or no water supply system right now, are to be constructed based on the BHN.

c. Target of Level-2 facility

Target communities for Level-2 facility were selected from each two candidates in every District (proposed by CWSA) into each one site, totally five communities by the Study Team. The selection was done through comprehensive examination on the population, emergency level, groundwater quality and quantity, activity of WATSAN Committee, waterborne diseases, workability, and so on. The procedures for the selection are shown in the Appendix of the Report.

These small towns have, as shown in the figures mentioned above, 3,100 to more than 7,000 of population but only one (Dadieso) to maximum four hand-pump wells (Manso Amenfi). That means the populations supplied water from one well are around 1,600 to more than 7,000, being enough competitive to the condition of Level-1 facility construction discussed above.

d. Attention to COM approach

Animation activities to the target communities shall be conducted with the utmost care and attention on the basic concept of COM (Community Ownership and Management), the backbone of CWSP.

3) Policy on construction conditions

In Ghana, several institutions organized by civil and/or construction engineers and labors, such as “the Council of the Ghana Labor Union on the Civil Engineering and Construction” or “the Ghana Institution of Civil Engineers”, are functioning actively working towards the Institution of Civil Engineer and Construction Business or

public agencies concerned. And there are many engineers with high education through a college or technical school. The construction works should be done hiring these local engineers aggressively.

Nowadays, so many construction works of roads, bridges, high buildings and so on are in progress, especially in large cities such as Accra or Tema. The traditional industries such as gold and bauxite mining are also still active, nevertheless their international prices are hovering at low level recently. By the conditions, the market of construction equipment/materials required by such industries is expanding remarkably. Thus, the working plan of the Project shall be formulated in emphasized to utilize such local contractors, equipment, and materials in Ghana.

4) Policy on local contractors and materials

a. Sub-contractors

There is a registration rule for private company on construction business, and the companies registered in MoWH are classified into four ranks from D-1 to D-4 for construction and from K-1 to K-4 for civil engineering business. Each rank has a limitation on the contract amount, e.g. the companies ranked at K-1, K-2, K-3 and K-4 can make the contract of more than 0.6 million, from 0.2 to 0.6, from 0.08 to 0.2, and less than 0.08 m$ respectively.

Based on the consideration that the height of some elevated tanks beyond 10m from the ground, and the contract cost of the water supply system shall be from 0.3 to more than 1.0 m$, the sub contractor for the Project must be ranked at least in K-2.

For the borehole drilling, sub-contractors shall be selected from the companies recommended by CWSA.

b. Local materials

Almost of all the equipment required for the Project, inclusive of hand-pumps, can be provided in Ghana (at Accra or Tema) through agents. Materials also can be obtained in Ghana except a few special materials such as water-proof paint. Thus, the local materials and/or equipment shall positively be utilized for the Project.

5) Agencies or organizations concerned to the implementation and O&M

a. CWSA, RWST, and DWST

The counterpart agency in Ghana is the CWSA, and the Western Regional Office of CWSA is the directly implementation agency of the Project. The staffs of CWSA Regional Office concerned to “water supply and sanitation” are called as the “RWST (Regional Water and Sanitation Team)”. Under the technical support of RWST, the District Water and Sanitation Team (DWST) that belongs to the each District Assembly (DA) manages and controls the activities of Partner Organization (PO; explained later), and makes a follow-up and monitoring of the activity of the WATSAN Committees.

The CWSA Headquarter manages and directs the RWST, and the RWST cooperates and guides the DWSTs technically. In the case of local project, the RWST makes contracts with the POs or SBDU(s) to conduct animation activities. The

DWST supervises the PO's activity, and cooperates and monitors the activity of the WATSAN Committees through periodical patrol of the communities. Such conditions and relationships are summarized in Figure 2.3.1.

As mentioned above, the practical working group on the animation who makes directly supervising and controlling the PO's activity and following up the WATSAN Committee's activity is the DWST, which is belonging to the DA, not in the line of CWSA. Then, the DWST has just been established based on the enforcement of CWSP within the DA's organization. That is still not matured as a public agency and having poor transportation means, which may be a vulnerable point for smooth progress of the animation and the Project itself. In consideration of such situation, to provide any support for the DWST shall be included in the component of the Project, in accordance with necessity.

b. PO and SBDU

The PO is a small scale local consultant or an NGO, which conducts actual animation activities such as a supporting on establishment of a WATSAN Committee by the inhabitants, an education or training to the Committee members and/or the communities to realize the concept of COM, under the sub-contract with the RWST. In the case of JICA Project, the contract shall be made with the Consultants.

A SBDU (Small Business Development Unit) is also a kind of PO but having high technology and knowledge on the water supply system, equipment, sanitation, etc. It makes rather high-level animation activities such as an organization of a union of WATSAN Committee called as a "WSDB" (Water and Sanitation Development Board) in the community having a Level-2 facility, or makes training to the PO.

c. Community, WATSAN Committee, and WSDB

CWSP emphasizes the concept of COM, and to put it concrete, the WATSAN Committee operates, maintains and manages the facility(s). The Committee checks the borehole facility(s) usually through the caretaker(s), collects a maintenance fund as a water charge through the money collector(s) and accountant. In the case of small town that has pipe-borne water supply system, the union of WATSAN Committees, the WSDB is organized and it makes actually an operation, maintenance and management of the facility(s).

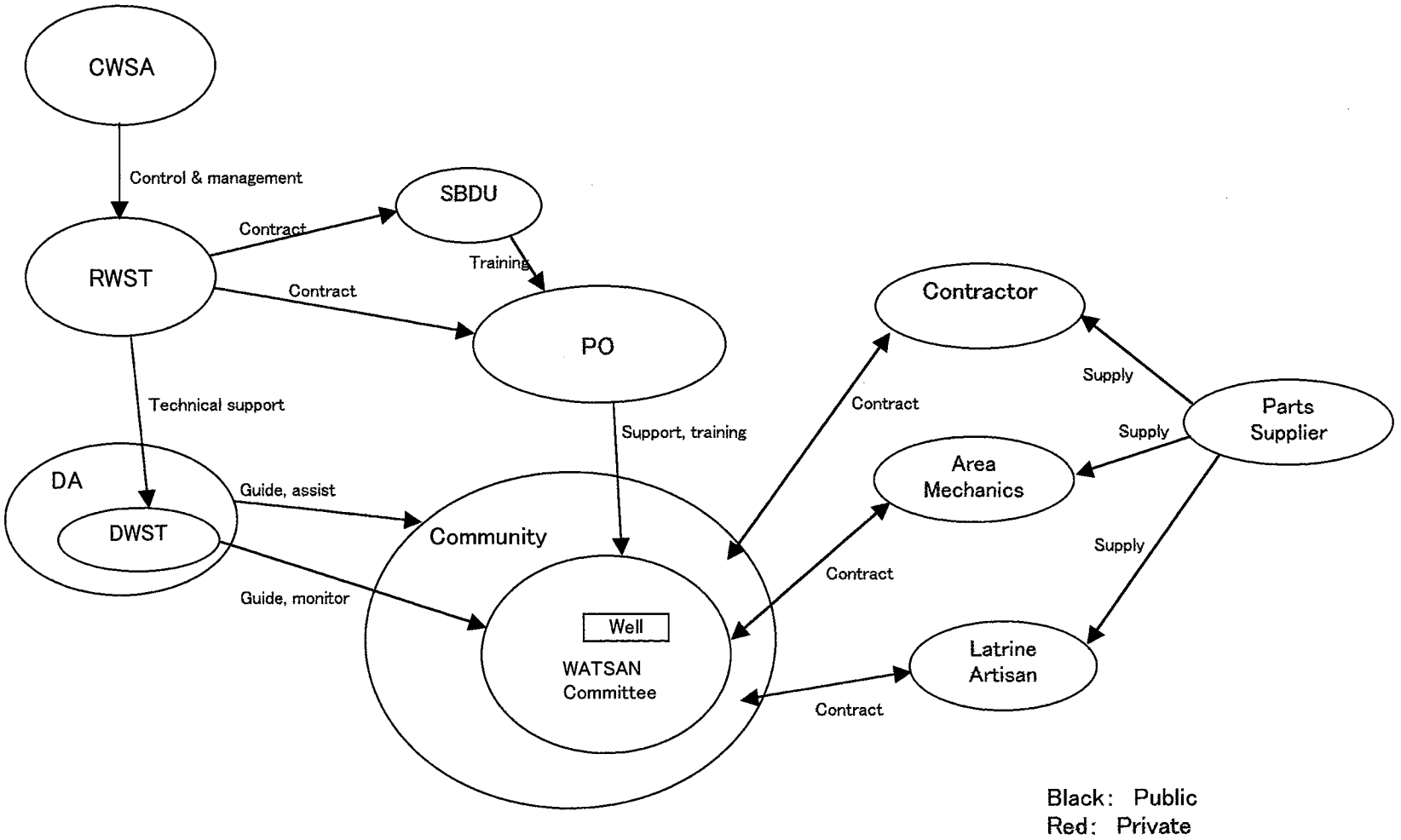
d. Private sector

Besides the governmental and public agencies, or the PO and the SBDU which directly concern to the community for water and sanitation, a private sector takes an important role in this field. They are, a "Contractor" to drill/dig a borehole or hand-dug-well requested by the Committee or individuals, an "Area Mechanics" to maintain a well facility or pump requested by the WATSAN Committee, a "Latrine Artisan" to construct a latrine requested by individual family, and "Parts Supplier" to supply parts and materials.

6) Policy on quality and quantity of the facilities

a. Level-1 facility

Figure 2.3.1. Relationship of Organizations concerned to Water Supply Project



Total 285 borehole facilities with hand-pump, ranked as higher than the second priority, shall be constructed at 242 communities in the five Districts. Well structure and platform shall be followed to the CWSA standard. Hand-pump for the facility shall be selected from the pumps listed below authorized by CWSA:

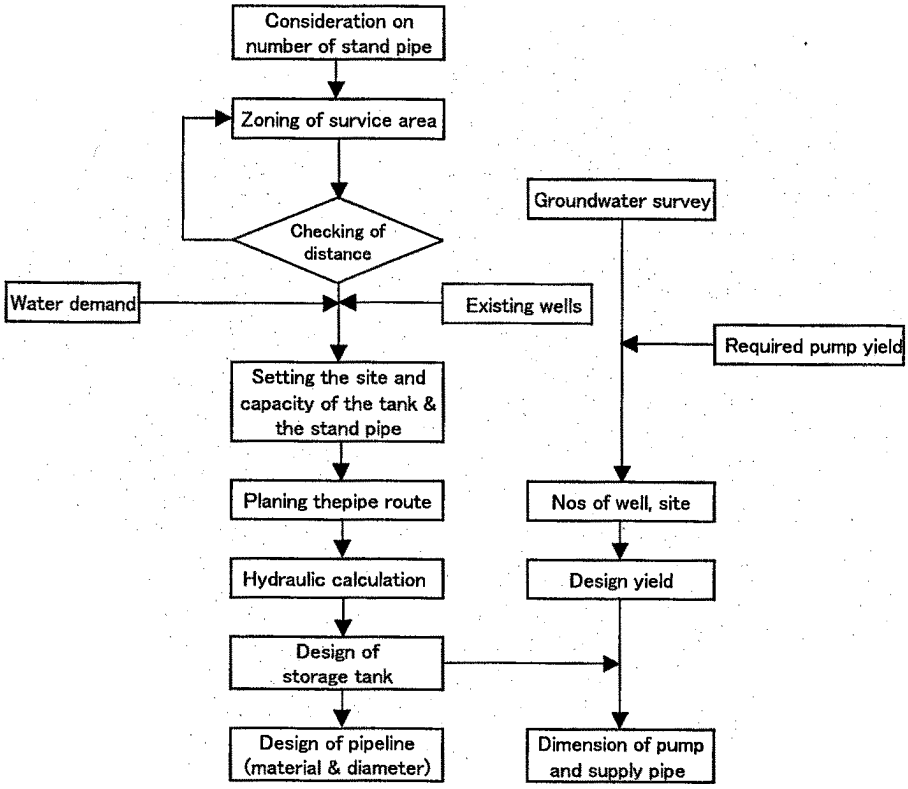
Pump	Pumping Head	Type	Pumping Rate
NIRA-85	for low head	direct piston	33 l/min
Afridev	for high head	foot pedal	29 – 13 l/min
VERGNET-60	for high head	lever handle	17.5 l/min
GMIM-II	for high head	lever handle	15 l/min

The design water demand for the Level-1 water supply system shall be 20 lcd, and a borehole facility covers 300 beneficiaries.

b. Level-2 facility

The water source of the Level-2 facility shall be groundwater. Type of the facility is to be "Storage tank and gravity flow". Scope of the design includes a water resources facility, supply pipeline, storage tank, delivery pipeline, and communal taps. The locations of communal taps are designed considering the population and house density of the community as well as the existing water sources, so that the water fetching distance does not exceed 500m from every household in the service area. The locations of the facilities were decided through the discussion between the community and the Consultants during the Basic Design Study (in the period of draft report explanation). Flowchart of Facility Design is shown as Figure 2.3.2.

Figure 2.3.2. Flowchart of Facility Design



c. Consultants Technical Assistance (“Soft Component”)

Ghanaian side shall conduct the animation activities in the promotion and the mobilization phases before the implementation of the Project, and in the follow up phase after the Project. While, Japanese side shall make the animation activities in the planning and the construction phases. A part of the animation activities in the planning phase has been done during the Basic Design Study period. The other animation activities by Japanese side shall be conducted in the implementation period, introduced as a “Soft Component” into the Project component.

For the financial source of animation activities by Ghanaian side, a contribution of the inhabitants (5% of the initial investment) is to be utilized.

d. Cooperation to DWST

In connection with the “Soft Component”, a certain support shall be provided to each DWST who plays an important role of the animation activities, to strengthen their activities and to make the animation effect at maximum.

Each DWST is to be composed of 3 members as a rule, namely Community Development Officer, Construction Technician, and Hygiene Educator. However, total 12 persons have been assigned actually in the five districts. In these districts, there are 242 villages and 5 small towns under their responsibility for the Project. It means one DWST member must cover more than 20 communities, and he must visit 4 villages a day, if he intends to patrol every village once in a week. It shall be, in consideration of the public traffic condition of the area, almost impossible schedule. To break the difficulty, providing any transportation means shall be the most effective, and the means shall be a motor-bicycle when the road/access conditions of the area and the costs of fuel and maintenance are considered into. One motor-bicycle for each shall be provided considering the number of member, working schedule and maintenance cost..

7) Policy on work schedule

The Project shall be conducted in two terms; Term-1 and Term-2.

After the Term-1 Project has been approved by the Japanese Government, the E/N shall be exchanged soon. Immediately after the E/N, the Consultant Contract shall be made, and then, tendering procedures shall take around 3 months. After those procedures, the Contractor Contract shall be contracted and approved by Japanese Government. During the term-1, construction of Level-1 facilities, siting of them, and animation activities concerned shall be conducted. Boreholes to be constructed in the term-1 are in 142 sites, nearly a half of the total construction number (285 sites).

The Trem-2 Project shall be approved by the Government in the next fiscal year of Japan, and the E/N shall be exchanged again. The E/N shall be expired by the end of this fiscal year, but it shall be extended to March of the farther next year. After E/N, the same procedures with the Term-1 shall go on. In the Tern-2 Project, remaining half of the borehole construction, all of the Level-2 facilities construction, siting of all borehole sites,

and animation activities concerned are to be conducted.

Summarized works schedule is shown in Figure 2.3.3. The works to be carried out in each term are also summarized in Table 2.3.1.

Table 2.3.1. Works trem-1 and Term-2

Items	Term-1	Term-2	Total
Level-1 facility			
Facility	142 sites	143 sites	285 sites
Drilling No.	189 holes	191 holes	380 holes
Animation	145 communities	145 communities	290 communities
Level-2 facility			
Facility	-	5 facilities	5 facilities
Drilling No.	-	21 holes	21 holes
Animation	-	59 committees	59 committees

2-3-2. Basic Design

1) Level-1 facility

a). Number of borehole facility

Total 285 borehole facilities are to be constructed at 242 communities ranked higher than the second priority in the five districts. The list of target communities with the number of borehole facility is attached in the Appendix.

b). Borehole successful rate

Successful rate of the borehole drilling is to be 75%. The total drilling shall be of 380 holes because of the successful rate. In every target community, the maximum drilling trial, in case of dry hole, shall be two times. After drilled two failed wells, no more siting or drilling shall be done at the community, and another community ranked as the third priority in the target community list shall be moved up to the actual target through discussion between RWST and the Consultant.

c). Well structure

Borehole structure must guarantee to yield clean and safe groundwater. For the purpose, the borehole shall be installed by PVC casing and screen pipes, back-filled the space between the casing and the hole by gravel. The thickness of the gravel packing must be more than 25mm (1inch). Casing diameter is to be 125mm (5inch) and drilling diameter is to be more than 200mm (8inch). To avoid the contamination due to the infiltration of surface water, at least 6.0m span of the well beneath the ground surface shall be grout-sealed. The depth of borehole is more than 35m, less than 80m, and 55m in an average. Standard well structure is shown in Figure 2.3.4.

d). Appurtenant facility

To make the pump facility easy to operate and maintain, as well as to prevent the infiltration of the surface water into the well, a concrete slab with a drain pit shall

Figure 2.3.3. Implementation Plan (Draft)

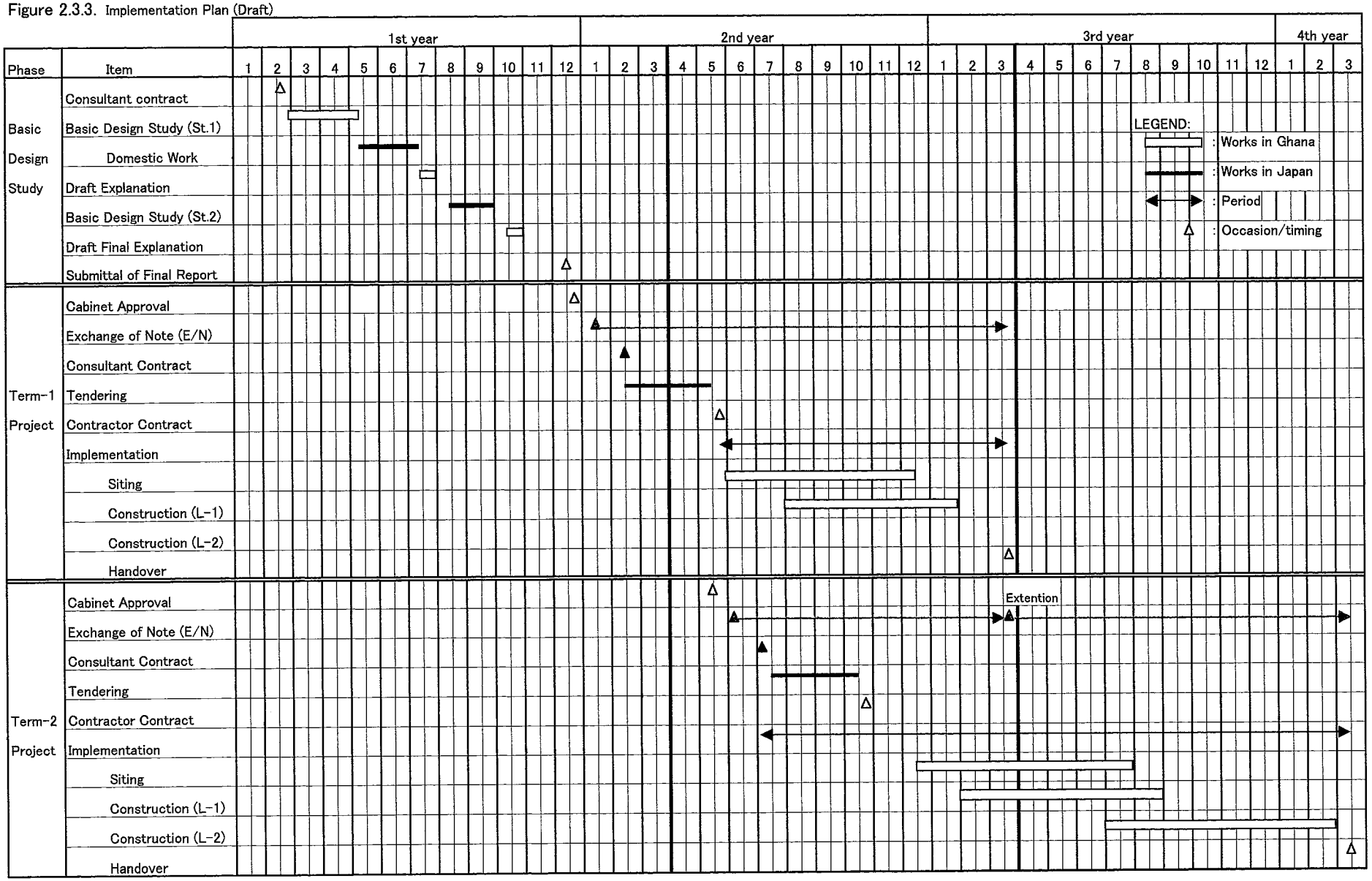
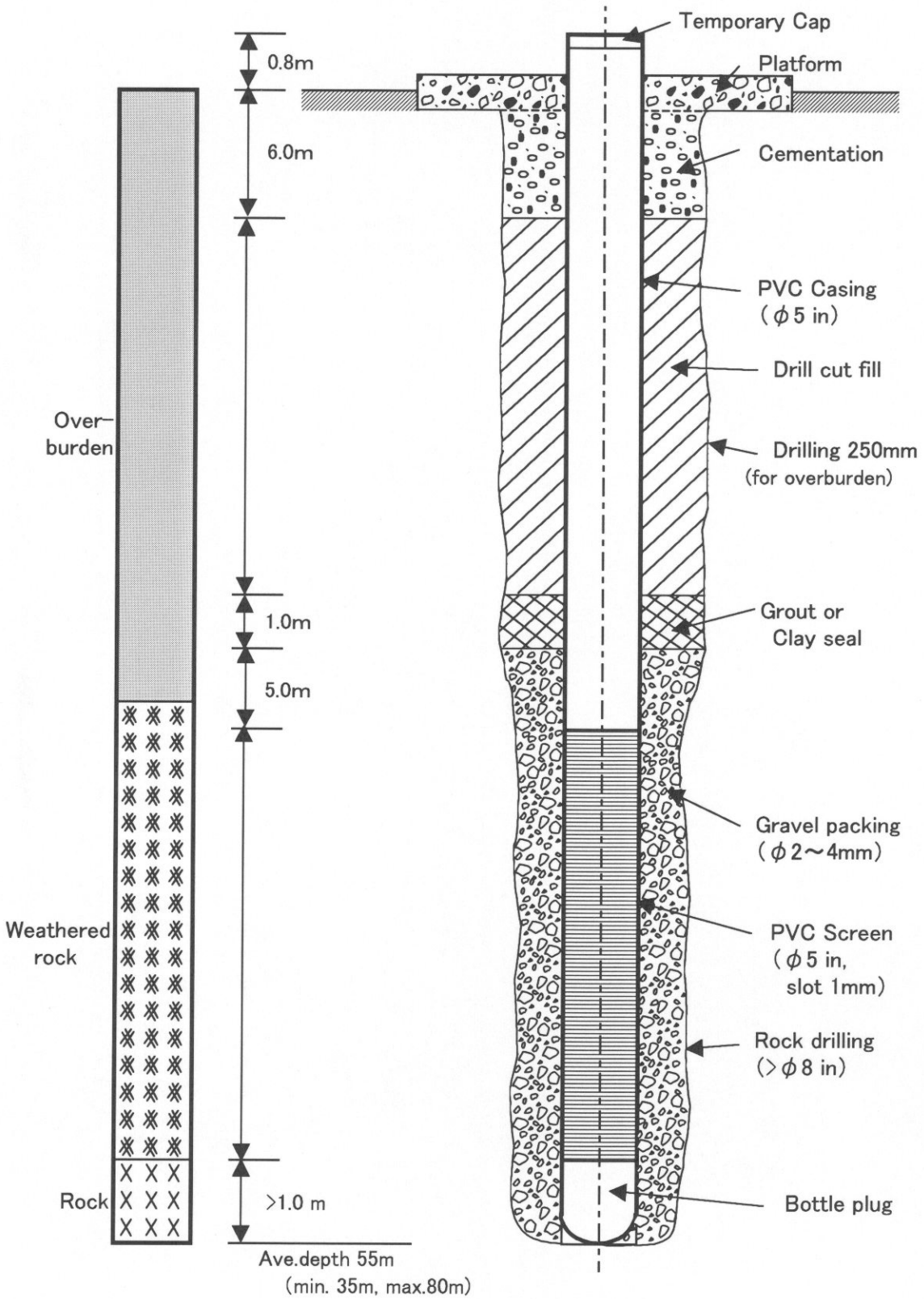


Figure 2.3.4 Standard Well Design (for Hand-pump facility)



be constructed. Although the CWSA standard indicates the concrete structure without iron-bar for the slab, a reinforced concrete shall be utilized from a safety viewpoint. The structures of these facilities are shown in the Design Figures attached.

e). Iron-removal facility

The facility is a concrete box with dimensions of 3.4 x 6.8 x 0.95m, and has two partitions inside. Because of the structure of aeration device, the hand-pump installed to the facility shall be a Vergnet Pump. The structures of the iron removal facility are shown in the drawings attached.

f). Hand pump

The hand-pumps to be installed in the well facilities are selected from the four types authorized by CWSA. Among them, the following combination shall be a standard, based on the distribution of groundwater table:

Low head pump (NIRA)	20%	57 sites (av. Head 15m)
High head pump		
for iron-removal facility (Vergnet)	5%	14 sites (av. Head 30m)
for all others (Afridev)	75%	214 sites (av. Head 30m)
Total		285 sites

g). Works volume

As mentioned so far, the works volume of Level-1 facility construction is summarized as Table 2.3.2. shown below.

Table 2.3.2. Works Volume of Level-1 Facility Construction

District	Target villages			Number of Facility	with I.R.F	Total Drilling
	Target	Investigated	Selected			
B.A.B	61	66	52	56	0	75
A. Suaman	76	77	59	68	2	91
W. Amenfi	62	56	44	57	4	76
N. East	53	47	28	34	4	45
W. West	88	76	59	70	4	93
Total	340	322	242	285	14	380

B.A.B: Bibiani-Anhwiaso Bekwai, A.:Aowin, W.: Wassa N.: Nzima

2) Level-2 facility

a). Water supply plan

Service population

The design criteria of CWSA suggest the design water demand includes the allowance for projected population within the design period, so that the service population shall be the present population.

Design water demand

Design water demand by CWSA is 45 lcd, and it includes:

- 20 lcd for 80% of service population,

- 60 lcd for 20% of service population,
- 10% for water supply to public and market facilities,
- 10% of water loss, and
- allowance for population increasing within the design period.

Averaged daily water use

Averaged daily water use is calculated as population x design water demand. The volume of storage tank is to be a half of the averaged daily water supply.

Maximum daily water use

Maximum daily water use is 1.5 times of the averaged one. The pump capacity shall be this volume by 16 hours operation.

Maximum hourly water supply

(2.5 times of averaged daily water supply) / 24

Number of communal taps

A communal tap serves 300 beneficiaries, and a stand pipe has two taps, so that, a stand pipe covers 600 of service population. A hospital shall have a stand pipe individually.

Those design water demand and supply, as well as the number of the standpipe in each community, are summarized as the following table (Table 2.3.3).

Table 2.3.3. Water Supply and Number of Standpipe

Item	unit	KK	NS	MA	DA	SU
Population	person	3,100	6,090	6,500	7,560	4,000
Water demand	lcd	45	45	45	45	45
Daily use (av.)	m^3/d	140	275	293	341	180
Daily use (max.)	m^3/d	210	413	440	512	270
Hourly supply(max.)	m^3/h	14.6	28.7	30.6	35.6	18.8
Pumping rate	m^3/h	13.2	25.9	27.5	32.0	16.9
Nos. of standpipe	site	5.5*	11	12	14	7

Note) KK: Kikam, NS: Nsuaem, MA: Manso Amenfi, DA: Dadieso, SU: Suburi

*: 0.5 means a standpipe with only one tap

Location of the stand pipes is decided through comprehensive consideration on the limitation of the community, distribution of the households, access distances, location of existing hand-pump wells, and so on (refer to the general plan maps in the Design Figures). Existing hand-pump wells are to be reserved for a tentative use in the maintenance time of the facility or for an emergency use.

b). Water resources plan

Water sources

Water source shall be a groundwater, withdrawn by mechanized pump through water well.

Water wells

- A yield of one well shall be 120 - 140 lit/min (from 2.00 to 2.33 lit/sec), and number of the well to be drilled shall be estimated from the required pumping rate but the minimum required is two.
- The well yielding less than 75 lit/min, based on the pumping test, shall be an un-successful well, and the design successful rate is 75%.
- Structures of the well are 200mm diameter of PVC casing and screen pipes, and 100m of standard depth. The length of screen shall be 20% or more of the drilling depth. Drilling diameter shall be more than 270mm (10-5/8 in).
- The location of wells is shown in the general plan map, but it must be reconfirm by geophysical prospecting in the course of implementation.

Pumps

The pump to be utilized is a submersible pump. Operation of switch on and off shall be done manually. Design draw-down of the water table is GL-40m, and the pump depth is set as GL-50m.

c). Facility plan

Type of the system

Water pumped up from deep wells shall be stored in a storage tank at once, and then, delivered to every communal tap gravitationally.

Hydraulic calculation

- William Harsens equation shall be utilized for the calculation of pipeline hydraulics. C-values of the PCV pipe shall be of 140.
- Minimum required head at communal tap shall be 3.0m
- Minimum diameter of the main pipeline shall be of 50mm.

Facility design

- Deep well: Explained above.
- Pump: Explained above.
- Supply pipeline: The pipeline to send water from deep wells to a storage tank. Pipeline system is not an individual but a union pipeline system from plural wells. Pipe shall be of PVC pipe. Pipe connection shall be a gum-ring type.
- Delivery pipeline: The pipeline to send water from a storage tank to each communal tap in gravity. The minimum pipe diameter shall be of 50mm, but the most suitable pipe diameter shall be applied. Pipe shall be of PVC pipe, and pipe connection shall be a gum-ring type. At the required positions, slues valve, drainage system, air-valve, etc., shall be installed. At the important points, such as a corner or branching, concrete protection shall be installed.
- Storage tank: Storage tank shall be an elevated or a ground type. The capacity shall be a half of design daily water use (average). Tank shall be constructed by reinforced concrete, and the structure shall be designed based on a careful strength and safety analysis. Height and the low water

level are to be decided in accordance with the field situation. Water meter of a float type shall be installed to observe the water level in the tank. A ball-tap valve is installed to stop the pump and prevent an overflow automatically when the tank is filled up during night.

- Communal tap: A standpipe has two taps and covers 600 service populations. It is made of concrete, having a base slab and drainage pipe. Every standpipe shall have a water flow meter.

e) Purchasing from the third country

Through a market research, it was confirmed that almost all of the equipment and materials required for the Project were available in Ghana. Only a few special materials, such as a waterproof paint and so on, are not available in Ghana, and to be purchased in Japan in this case.

3) Design and plan

All of the figures on plan and design are shown in a portfolio attached.

Chapter 3. IMPLEMENTATION PLAN

3.1. Implementation Plan

3.1.1. Implementation Concept

1) Basic concept

The implementation agency of the Project is the CWSA under the MoWH, but actually its regional office in Western Region. Technical level and experience of the CWSA or its regional office on the implementation of water and sanitation programs are no problem, however, it is also obvious that the numbers of staff for both are not sufficient. The implementation plan shall be formulated carefully taking such situation into the consideration.

Both of the construction works for Level-1 and Level-2 facilities shall be conducted by Japanese Contractor, sub-contracting local drilling company(s) and civil contractor(s). For the Level-2 facility construction, the local contractor(s) ranked as or more than K-2 level shall be contracted, in considering with a required technical level, a mobilization availability on equipment and materials, and a financial capacity.

For the formulation of implementation plan, the utmost cares on the efficiency, the effectiveness and the economy of the Project shall be paid because the Project shall be implemented under Japan's Grant Aid, it includes many work items, and it takes rather long period consequently. Major concepts, based on the above mentioned consideration, shall be described below.

a. Works volume

The works volume of the Project is summarized as Table 3.1.1. (duplicated from Table 2.3.1. in the previous chapter).

Table 3.1.1. Works Volume of the Project

Items	Term-1	Term-2	Total
Level-1 facility			
Facility	142 sites	143 sites	285 sites
Drilling No.	189 holes	191 holes	380 holes
Animation	145 villages	145 villages	290 villages
Level-2 facility			
Facility	-	5 facilities	5 facilities
Drilling No.	-	21 holes	21 holes
Animation	-	59 committee	59 committee

b. Workable days

Conditions

i. Working time: 8 h/day (10 h/day for drilling works)

ii. Yearly holiday: 52 days

iii. National holiday: 8 days
iv. Traditional holiday: 2 days
v. Shutdown: 30 days (June)
vi. Rainy day (>10mm of rain): 37 days (average of 5 years)
vii. Double counted: 4 days (Sundays in June)

Workable days

Workable days = 365 – (52+8+2+30+37) + 4 = 240 days
Workable rate = 240 / 365 = 0.658

c. Working party

Based on the total works volume, a daily works progress and a workable rate, the required working days for each work item can be calculated. Then, the required work parties for every work item to complete them within the available work period in each term, excepting the preparatory works, site clearances, handing over periods and so forth, are calculated as shown in Table 3.1.2. Thus, the Project shall be implemented by the numbers of work parties shown in the said table.

2) Dispatch of Engineer

All of the work items to be conducted under the Project are mostly common works in Ghana, qualitatively and quantitatively. It shall be no need to dispatch any special engineer from Japan or other counties.

3) Implementation System of Ghanaian Side

Figure 3.1.1. shows an organization of the CWSA, and the main implementation system of the Ghanaian side is to be the Regional Office (of Western Region) in the figure. The Project shall be implemented under the initiative of the Regional Office, cooperated

Figure 3.1.1. Organization Chart of CWSA

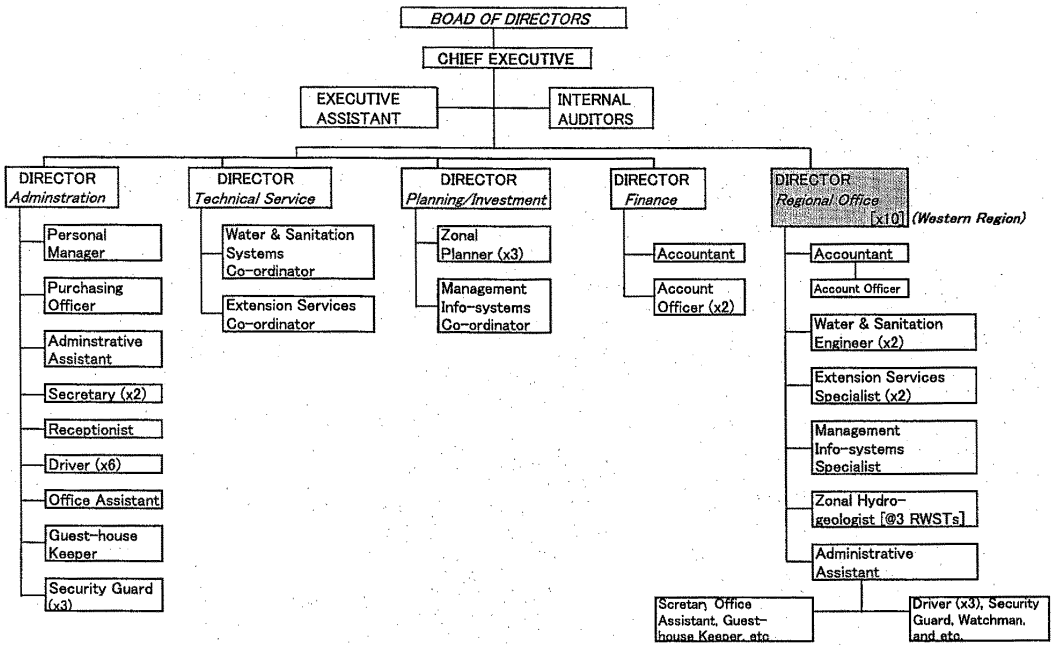


Table 3.1.2. WORK PARTIES REQUIRED

Work Item		Party	Work volume				Daily progress	Workable Rate	Required work days		Available work period		Required parties	
			Term-1	Term-2	Total	Unit			Term-1	Term-2	Term-1	Term-2	Term-1	Term-2
Animation	Animation	PO	145	204	349	Com.*	0.25	0.658	881	1240	180	180	5	7
Siting	Geoelectric prospecting (vertical)	Planning	189	212	401	site	3.33	0.658	86	97	180	210	1	1
		Measuring	189	212	401	site	0.833	0.658	345	387	180	210	2	2
		Analysis	189	212	401	site	2.222	0.658	129	145	180	210	1	1
	Geoelectric prospecting (hoizontal)	Planning	189	212	401	site	10.00	0.658	29	32	180	210	1	1
		Measuring	189	212	401	site	2.50	0.658	115	129	180	210	1	1
		Analysis	189	212	401	site	6.67	0.658	43	48	180	210	1	1
Construction Works	Level-2 Facility	Concrete	0	5	5	site	0.00645	0.658	0	1,178	–	255	–	5
		Pipeworks	0	5	5	site	0.00971	0.658	0	783	–	255	–	4
	Level-1 Facility	Drilling	142	159	301	site	0.364	0.658	593	664	180	210	4	4
		Punping test	142	159	301	site	1.250	0.658	173	193	180	210	1	1
		Earth works	142	159	301	site	0.752	0.658	287	321	180	210	2	2
		Mechanics	142	159	301	site	1.471	0.658	147	164	180	210	1	1
	(dry-hole)	Drilling	47	53	100	site	0.474	0.658	151	181	180	210	1	1

*: Com. : Community

with the CWSA Headquarter and the DWSTs under the concerned DAs. However, those organizations are suffered from chronic shortage of the staff, and the Consultants are required to cooperate with them in every aspect they can do.

3.1.2. Implementation Conditions

1) Conditions on construction works

In Ghana, there are two laws providing the labors' rights and standard. Based on the laws, labor and employer make an agreement each other annually, to prescribe wages and work conditions in detail. In the Project also, the agreement between the labors and the employer in accordance with the laws shall be contracted. Major items on the agreement are summarized below:

- Work time: 40 hours/week, 8 hours/day (8:00-17:00), when 2 shifts work (6:00-18:00, 18:00-6:00)
- Over time: 125% of normal (mon. to fri.), 150% (sat.), 200% (sun.)
- Yearly paid holiday: 28 days (common), 36 days (management)
- Sick off: full pay for 2 months, a half pay for 2 months after that, in the case of employee for more than 3 month and less than 3 years.
- Social insurance: insurance for family's hospital fee 160,000 Cedi/3 months, if no-pay 48,000 Cedi/year as a bonus.
- Funeral ceremony: 240,000 Cedi and transportation fee.
- Allowance: 580 Cedi/day for tools, 4,800 Cedi/night with a lodging and 16,000 Cedi/night without lodging, one-month wages for transfer, 125% of over time wage for midnight works, 120 Cedi for daily transportation.
- Dismissal: 27 days wages when noticed one month ahead.

2) Characteristics of the project area

The Project Area, the Western Region, is situated at the western end of Ghana, and because of rather worse road conditions it takes considerably long time to transport equipment and materials to the work sites from Tema Seaport or the capital. Then, the area has the heaviest rainfall in Ghana which influences the works progress in rainy season. And the area has quite poor telecommunication networks. Thus, the work schedule shall carefully be formulated taking those local conditions into the consideration. Furthermore, water-borne diseases still remain in the area, so close relations with a clinic or hospital in the area must be built up.

3) Attentions on Law and Regulation

Concerning to the establishment of private company, there are regulations such as "Regulation Certificate (Act 478)", "Certificate Incorporation (Act 179), and "Certificate to Commence Business (Companies Code 1963)". The sub-contractors involved into the Project must be the companies certificated by these regulations. The Consultant and the

Contractor must follow these regulations. When they employ local people, a completed "Employ Agreement" prescribed the conditions of over time wages, dismissal procedures, and so on, shall be provided.

3.1.3. Scope of Work

1) Level-1 facility

a. Preparations of access road and/or the stockyard for construction materials are to be carried out by the inhabitants, when they are required.

b. To make a fence around the water supply facility, or to set a key to the facility shall be done by the inhabitants, if they need.

c. To set a signboard indicating the existence of well facility(s) constructed by JICA, at the entrance of the community.

2) Level-2 facility

a. Preparations of access road and/or the stockyard for construction materials are to be carried out by the inhabitants, when they are required.

b. Acquisition and land preparation for the construction site shall be done by Ghanaian side.

c. For the electrical works, the distribution line to the site shall be covered by Ghanaian side, and the drop wiring and internal wiring within the site, as well as the main circuit breaker and transformer, are included in the Project component.

d. The fence enclosing the storage tank shall be constructed by Japanese side.

3) Animation

a. Animation activities in the Promotion and the Mobilization Phases are to be performed by Ghanaian side as a rule.

b. Animation activities in the Planning and the Construction Phases are to be covered by Japanese side.

c. Animation activities in the Follow-up Phase shall be done by Ghanaian side.

3.1.4. Consultant Supervising

1) Policy on the supervising

The Project Office shall be established in the CWSA Regional Office in Western Region, and therefore, the base camps of the Consultant and the Contractor shall also be settled up in Takoradi, to make it easy to communicate with each other. The site camps of the Sub-contractor shall be settled at each construction site, and controlled by the engineers of Consultant and Contractor.

2) Supervising system

The base camps of both Consultant and Contractor are to be settled in Takoradi for smooth and close contact with the CWSA, as mentioned above. Actual construction

works of both Level-1 and Level-2 facilities shall be carried out by the local contractors under the sub-contract with Japanese Contractor. Because of the scattered locations of the construction sites in the five districts, the engineers of the Consultant and the Contractor shall go round every site regularly to make a management of work progress and a control of works quality. For the drilling works, a Japanese drilling expert and some local experts for drilling shall be stationed at each site camp (District camp) to make management and control the works because the works progress is quite rapid.

Siting works for drilling points were completed within the B/D Study period as a rule. However, the exact drilling points shall be sited and proposed by the Contractor, and the Consultant's Resident Engineer examines and approves the points. For the purpose, the hydrogeologist of the Contractor shall station at the site camp in each district. The animation activities shall be carried out by POs under the contract with the Consultant, trained and supervised by the Animation Expert/ the Resident Engineer of the Consultant.

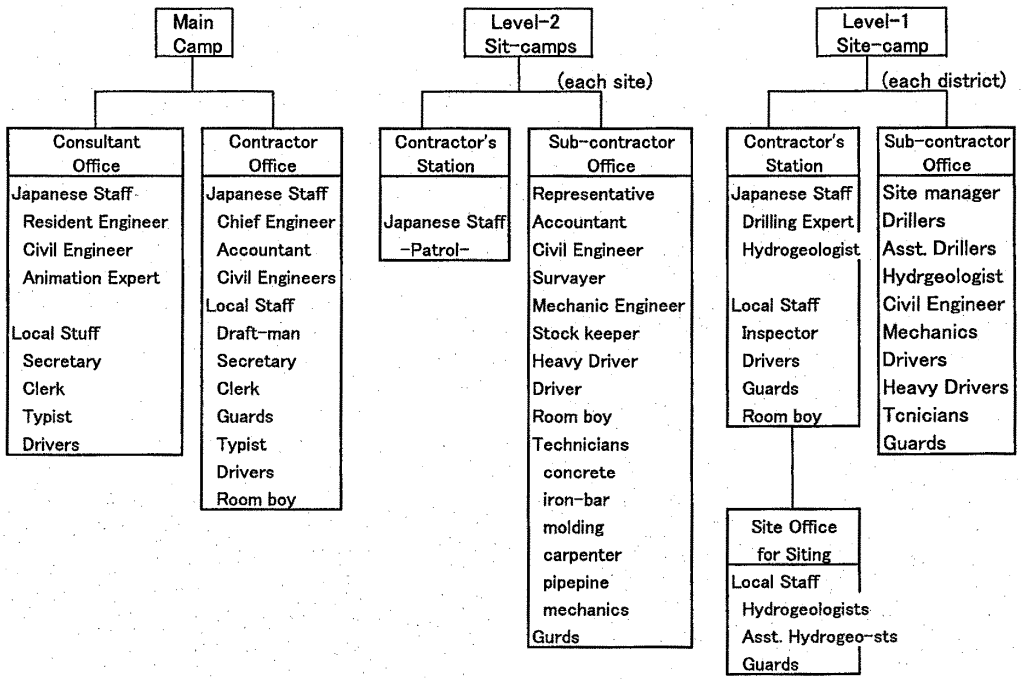
3) Station of supervisor

Basically, the supervising engineer of the Consultant shall stay at the base camp in Takoradi. When required, they shall stay at proper hotel in each District to supervise the works of construction and drilling.

4) Consultant's staff and activity

Supervising staff of the Consultant shall be consisted of three experts, namely the Resident Engineer, the Civil Engineer, and the Animation Expert. Besides the supervising of the Contractor's works, the Consultant shall make an approval on siting works of the Contractor and animation activities employing the POs. The supervising system, mentioned above, is summarized in Figure 3.1.2.

Figure 3.1.2. Supervising System



3.1.5.Procurement Plan

1) Conditions of procurement in Ghana

In the current three years, the construction works in Ghana for building and housing, roads, or bridges, are remarkably expanded and the materials for those construction works become prevailing in the market consequently. Among those, concrete aggregates, cements, concrete blocks, roofing materials, wall/floor materials, and PVC pipes are produced in Ghana. While, an iron bar, a steel pipe, a construction equipment, vehicles, and electric goods, are the mostly imported materials. In particular, the electrical goods have been prevailing in the market recently, and stationeries or furniture with high quality become also available.

2) Conditions of operation and maintenance

A routine operation and maintenance of the water and sanitation facility(s) in the community is to be carried out by the community, WATSAN Committee in the concrete saying, based on the concept of COM. However, a repairing system for the severe troubles on pump or equipment has not yet been established. In addition to that, a network of spare-parts suppliers is also not yet built up. At least two suppliers shall be needed in each District. The situation is, however, gradually going well through the efforts of German's "Conversion Program".

Right now, the spare parts of hand-pump are available through agents of pump-makers, at Accra or Tema. The spare parts of submersible pump are to be ordered to the maker when or after provided the pump.

3.1.6. Soft component plan

1) Background

Although it is rather easy to construct a facility, it is a quite tough challenge to operate and maintain it steadily for long period, in other words, to ensure the sustainability of the facility, for both donor and recipient country even now.

To keep the sustainability of the facilities, the Government of Ghana shifted the policy on O&M from governmental management to COM (Community Ownership and Management), based on the new national development plan in the water and sanitation field, namely "CWSP". And for the smooth and certain shift to the community ownership, a series of animation activities such as to educate the inhabitants, to organize a WATSAN Committee, and to train the committee member to ensure the capacity and activity of the Committee, is to be conducted.

Ghanaian Government strongly recognized that the animation is quite important for the entire projects to ensure their sustainability. Originally, the former GWSC performed the animation activity through its CWSD (Community Water and Sanitation Division), but the GWSC soon noticed that more effective and careful animation could be done by the private sector than the governmental agency. And then, the GWSC positively promoted the small consultant or the NGO who conduct an animation activity especially, namely

"PO", in cooperation with donor countries, and continued the animation activities to the communities but employing the POs.

In the Project, Ghanaian side requested Japan to cooperate a part of animation activities, after having expressed that they should make the maximum effort on the animation by themselves through the discussions on the Basic Design Study.

2) Objectives

The direct objectives of the Project are to provide the access to proper potable water, and to ensure the sustainability of the water supply systems through the concept of COM. And the goals are to eradicate water-borne diseases, raise up sanitary level, reduce water fetching work, activate production works, and to expand the agricultural and economic activities. To achieve the goals, not only the hard approach such as to design and construct the appropriate facility and so on, but the soft approach such as the animation is required. These objectives, direct goals and the final goals of the Project are summarized as shown in Figure 3.1.3.

Soft component of the Project is to provide the Consultants' technical assistance to the part of soft approach shown in the said Figure.

3) Activity and Outputs

In Ghana, a project cycle is divided into five phases namely; a) Promotion, b) Mobilization, c) Planning, d) Construction, and e) Follow-up Phases, and a certain proper animation to the inhabitants is to be conducted in each phase respectively (refer to Figure 3.1.4). The actual animation activities to be performed in each phase, implementation body, and expected responses of the inhabitants, as well as its outputs, are summarized in Table 3.1.3. Each period needed for the animation activities by POs is 3 months, totally 12 months, excepting the animation in Promotion Phase that is to be done by the Government. A series of animation activities from Mobilization to Follow-up Phases, taking 12 months, is called "a Package" and the contract cost of the PO for one package is said as 500 US$ for a community.

When the proper animation activities have been conducted at each project cycle, the following outputs can be expected respectively (see Figure 3.1.4):

a. Current water supply conditions and demands of the inhabitants are grasped,
b. WATSAN Committee is established and the Letter of Acceptance is issued,
c. Inhabitants' contribution for the initial investment (5%) is funded and "Facility maintenance Plan (FMP)" is formulated,
d. Maintenance fund is established based on FMP,
e. O&M by the community are commenced, and the maintenance network among WATSAN, area mechanics, and DWST is built up.

As mentioned above, the CWSA is positively promoting the POs, and making a training or re-education to them periodically, to keep or increase the level of their ability

Figure 3.1.3.

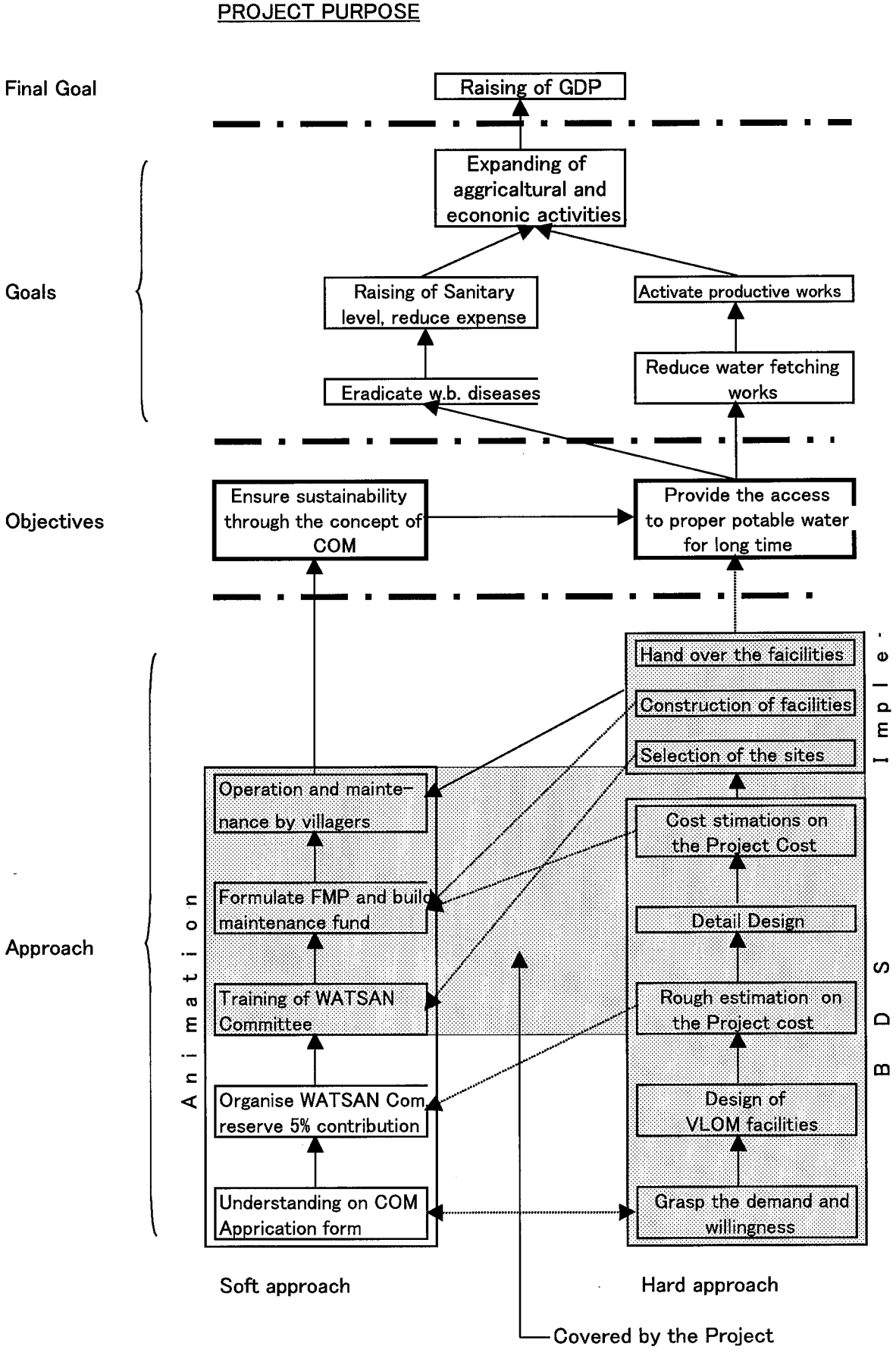

PROJECT PURPOSE
Final Goal
Raising of GDP
Goals
Expanding of aggricaltural and econonic activities
Raising of Sanitary level, reduce expense
Activate productive works
Eradicate w.b. diseases
Reduce water fetching works
Objectives
Ensure sustainability through the concept of COM
Provide the access to proper potable water for long time
Approach
Hand over the faicilities
Construction of facilities
Selection of the sites
Operation and mainte-nance by villagers
Cost stimations on the Project Cost
Formulate FMP and build maintenance fund
Detail Design
Training of WATSAN Committee
Rough estimation on the Project cost
Organise WATSAN Com. reserve 5% contribution
Design of VLOM facilities
Understanding on COM Apprication form
Grasp the demand and willingness
Animation
Implementation
Soft approach
Hard approach
Covered by the Project

Figure 3.1.4 CONCEPT OF PROJECT CYCLE

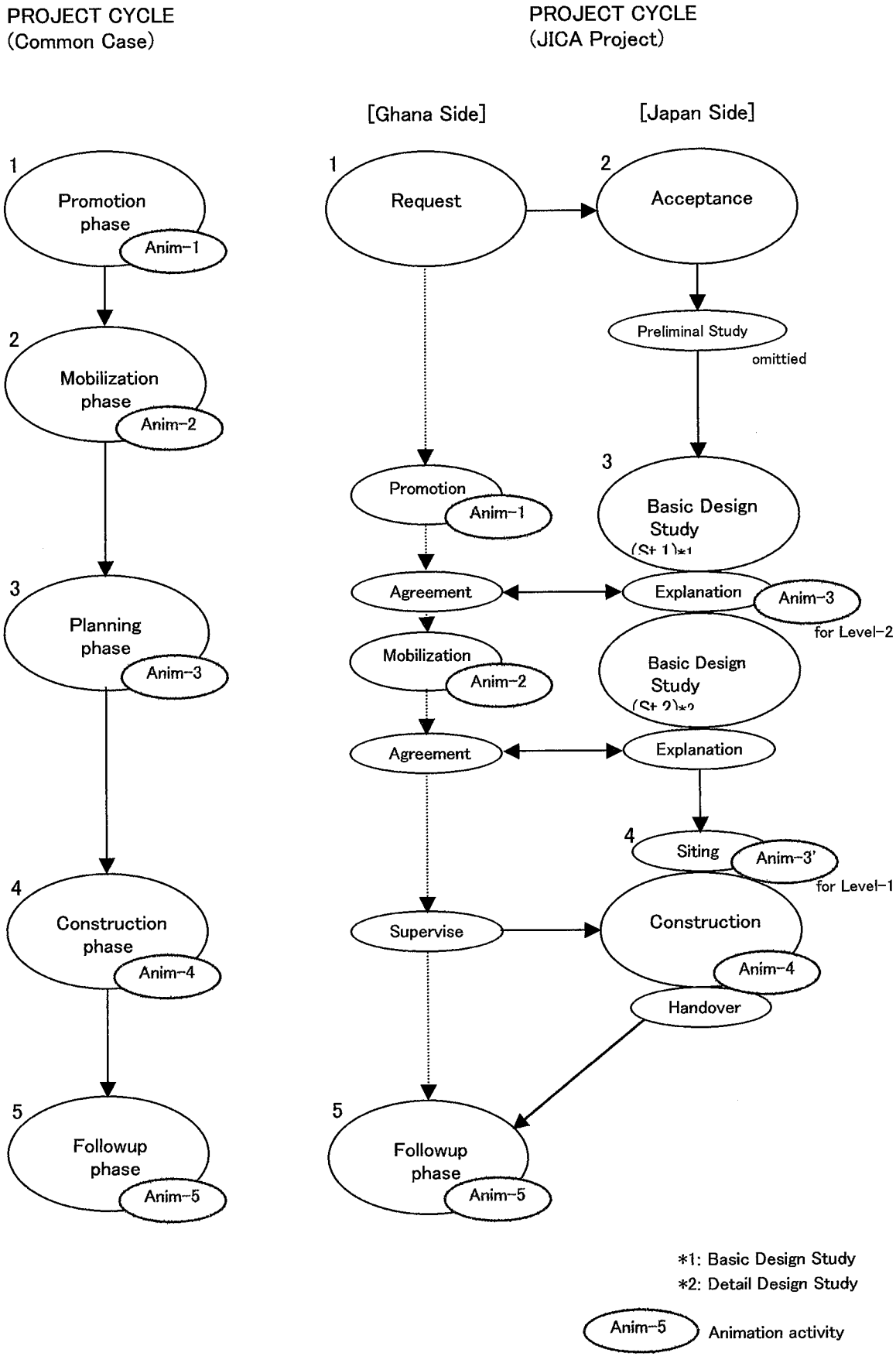


Table 3.1.3 PROJECT CYCLE AND MAJOR ANIMATION ACTIVITIES

(in the case of Common Project)

Cycle	Major Animation Activity	by	Community's Action
	a. Inform community about Program.	CWSA/DA	a. Find put CWSP.
	b. Verufy community interest/need.	DWST	b. Apply for construction grant to build new water supply.
1 PROMOTION	c. Collect baseline data.	DWST	
PHASE	d. Approve application/report to RWST.	DA	
	e. Contract community animation work with PO.	CWSA/RWST	
2 - 3 months	f. Training of PO.	CWSA	
(Output)	**Needs of the Community/Trained PO**		**Application for new facility**
	a. Build participatory process for community decision-making.	PO	a. Involve women in meeting.
	b. Study existing situation.	PO	b. Develop understanding of CWSP.
2 MOBILIZATION	c. Explain CWSP and build awareness of responsibility for	PO	c. Make commitment to change.
PHASE	management.		d. Form WATSAN Committee.
	d. Build commitment to new water supply .	PO	
	e. Help the community establish a WATSAN Committee.	PO	
2 - 3 months	f. Organize hygiene/sanitation promotion.	PO	
	(g. in case Level-2, help the community establish a WSDB).		(e. in case Level-2, establish WSDB).
(Output)	**WATSAN Committee (&WSDB)**		**Letter of Acceptance**
	a. Provide initial training for WATSAN Committee.	PO	a. Choose technical option.
	b. Facilitate decision-making on technical option and siting.	PO	b. Choose siting of new facility.
3 PLANNING	c. Facilitate planning on how to manage the new facility.	PO	c. Write Facility Management Plan (FMP).
PHASE	d. Help with writing of Facility Management Plan (FMP).	PO	d. Raise funds for capital cost (5%).
	e. Facilitate discussion on raising funds and openning bank	PO	e. Open bank account.
	account.		f. Organize hygiene/sanitation action.
2 - 3 months	f. Support hygiene/sanitation action.	PO	g. Promote latrine construction.
(Output)	**Design/Work plan reflected people's opinion**		**FMP, 5% of contribution**
	a. Help supervise construction and organize material/labour	PO	a. Organize inputs to construction (access road, labour,
	inputs.		materials).
4 CONSTRUCTION	b. Train WATSAN Committee and caretaker.	PO/area mechanics	b. Supervise construction.
PHASE	c. Facilitate discussion on how to establish Maintenance Fund.	PO	c. Establish Maintenance Fund.
3 - 4 months	d. Support hygiene/sanitation action.	PO	d. Hygiene/sanitation action.
(Output)	**New Water Supply Facility**		**Maintenance Fund**
	a. Train WATSAN Committee.	PO	a. Record-keeping for pump repair.
	b. Facilitate maintenance system.	PO	b. Establishmaintenance system.
5 FOLLOWUP	c. Support hygiene/sanitation action.	PO	c. Higiene/sanitation action.
PHASE	d. Assist with network building.	PO	d. Establish links with WATSANs, Area Mechanics, and
3 - 4 months	f. Monitoring and evaluation.	DWST	DWST.
(Output)	**Project Sustainability**		**O/M Network**

on the animation. During the animation activity by the POs, the DWST under the DA makes patrol around the target communities to cooperate, direct, and supervise the activity of the POs.

4) Work component in each term

The Project shall be carried out in two phases; term-1 and term-2. Timing of each animation activity and their outputs are illustrated in Figure 3.1.5.

As shown in the Figure, the animation activity was commenced since the Basic Design Study was started. Major activities in this duration were to be done by Ghanaian side but some parts had been conducted by the Consultant.

In the course of implementation, in the term-1 at first, the animation shall be commenced immediately after the Contractor's Contract. Through the animation activity, a 5% of inhabitants' contribution shall be reserved and the FMP shall be formulated by the commencement of construction work. By the end of construction works, a certain amount of maintenance fund shall be reserved.

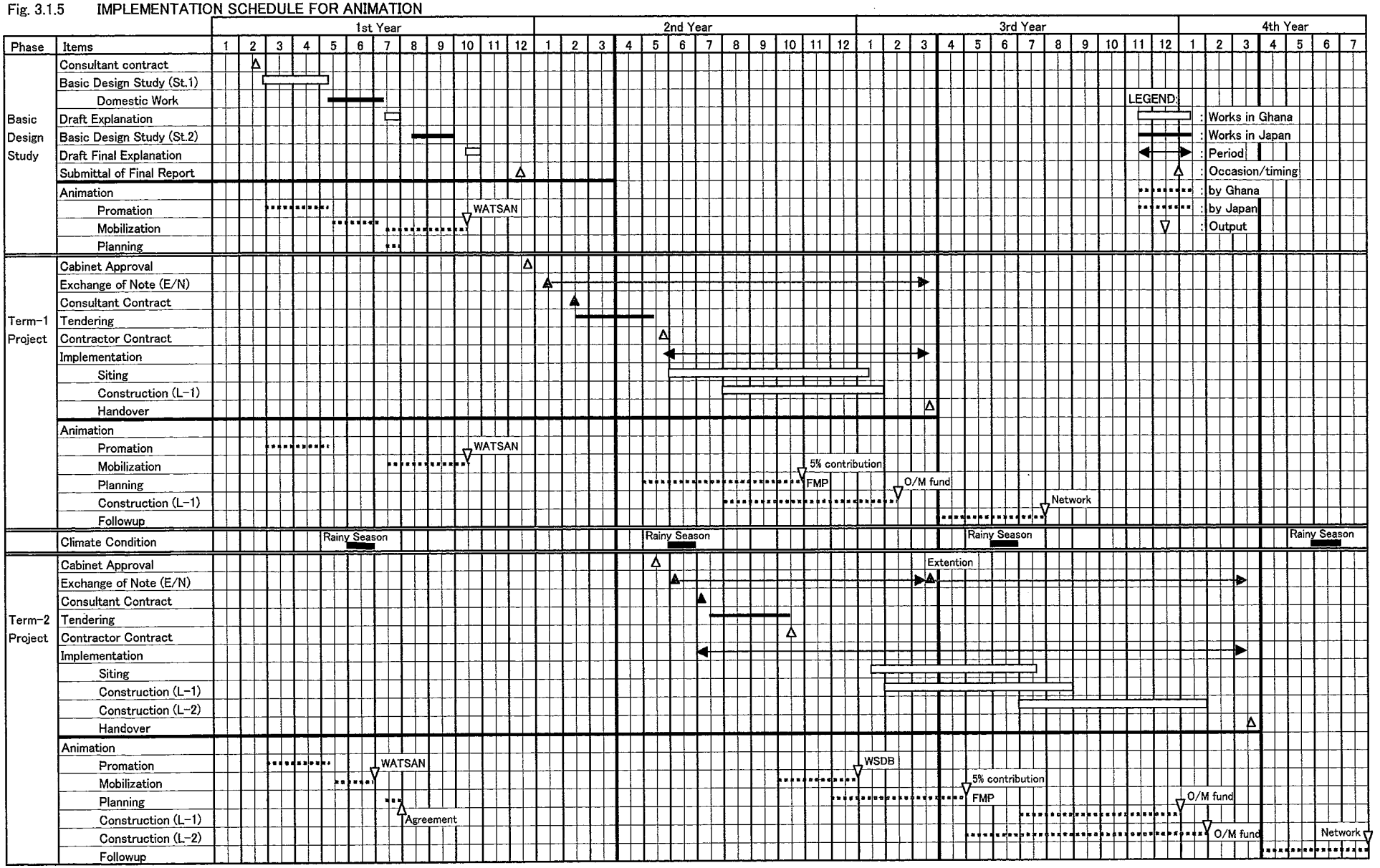
In the term-2 Project, the construction works of both Level-1 and level-2 facilities shall be conducted. In this condition, the animations for the target communities of Level-1 facility shall go on as same as the term-1 period. For the target communities on Level-2 facility, a WSDB which is a union of WATSAN Committees in the community shall be organized at first (the WATSAN Committees should be established during the Basic Design Study period by the CWSA). Then, the 5% of initial investment shall be reserved as the inhabitant's contribution, and the FMP on the facility shall be formulated through the animation. By the end of the construction works, a maintenance fund based on the FMP shall be built up at each target community.

5) Inputs in detail

Excepting the animation activity done in the B/D Study period, Japanese side shall dispatch an animation expert as a member of the Consultants and make animation activities in the Planning and the Construction Phases. In the Planning Phase, the expert shall conduct a) preparation of well maintenance manual, b) training POs on the manual, c) actual animation activities to the inhabitants and WATSAN Committee instructing POs sub-contracted, and so forth. In the Construction Phase, he shall make a) preparation of facility maintenance manual, b) training to POs or SBDU on the manual, c) actual animation activities to the WSDB and the caretakers instructing PO or WBDU under sub-contract, and c) etc.

To perform those activities at each phase, around 1.2 months of assignment of Consultant's animation adviser shall be required for both term-1 and term-2 Projects. The Adviser shall select the POs (and the WBDU if need), make contract with them, prepare the maintenance manual, explain and train the sub-contractors according to the manuals, and manage/supervise them. During the period when the Adviser is absent, the Residential Engineer shall continue the managing and controlling the POs. Thus, the inputs in detail are summarized as follows:

Fig. 3.1.5 IMPLEMENTATION SCHEDULE FOR ANIMATION



Inputs in detail for Animation Activities

Term-1

Expert	1 p x 1.2 months	1.2 mm
Allowance, etc.		1 LS
Field Expenses	car rental, etc.	1.2 months
Preparation of manual		1 LS
Sub-contract	PO for 145 com.	1 LS

Term-2

Expert	1 p x 1.2 months	1.2 mm
Allowance, etc.		1 LS
Field Expenses	car rental	1.2 months
Preparation of manual		1 LS
Sub-contract	PO for 204 com.	1 LS

3.1.7. Implementation Schedule

The work schedule is summarized as the Table 3.1.4.

3.1.8. Obligations of recipient country

The undertakings of the Government of Ghana for the Project are as follows:

(1) To make available the land for constructions,

(2) To check the access conditions to the target communities, and make arrangement if necessary,

(3) To build up a fence and lock around the Level-1 facility, if necessary,

(4) To set up a signboard indicating the existence of well facility(s) constructed by Japanese cooperation at the entrance of the community.

(5) To provide tax exemption for the equipment to be procured,

(6) To provide tax relief to all Japanese staff engaged in the implementation of the Project during their stay in Ghana,

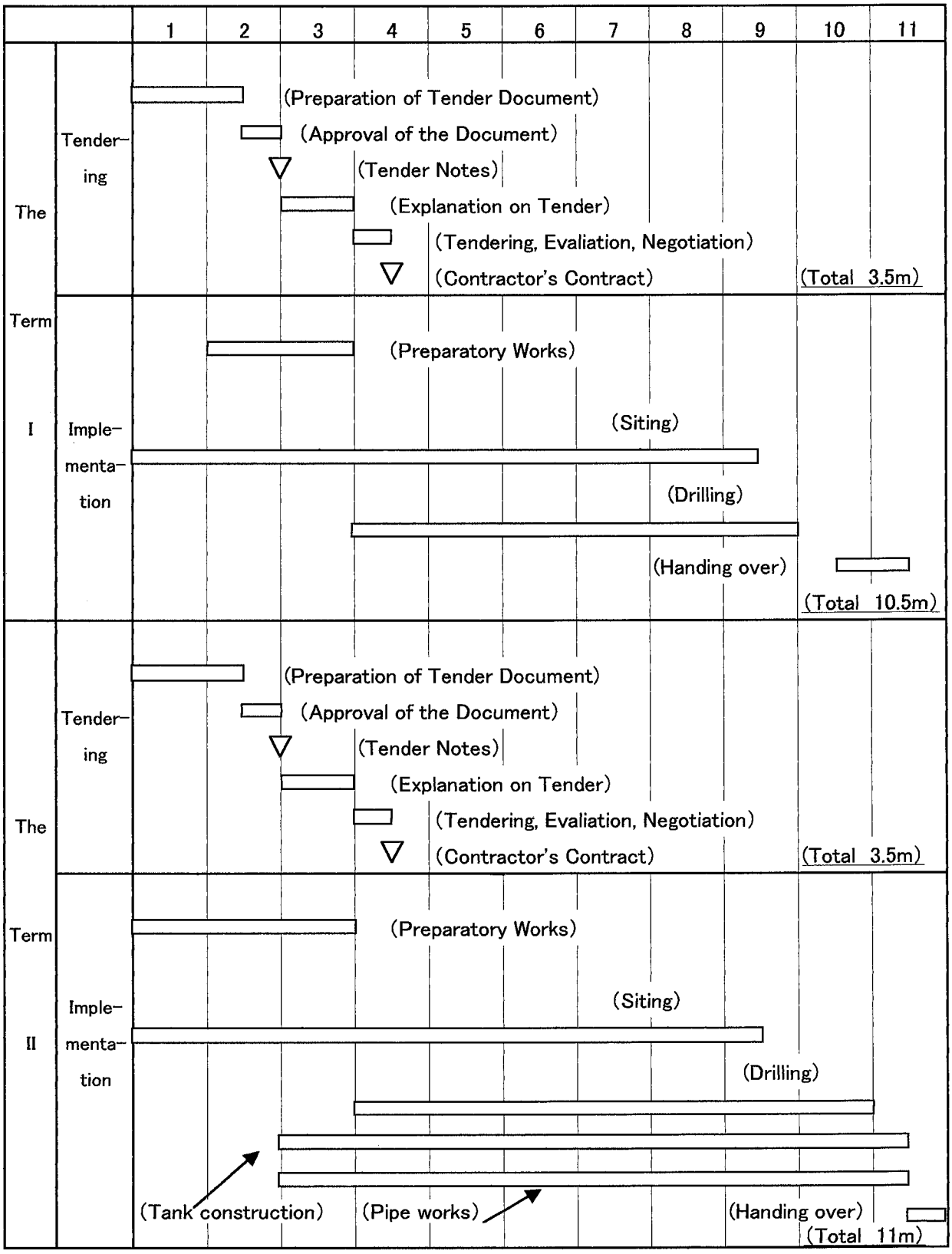
(7) To facilitate the necessary measures for the embarkation and disembarkation and the stay of Japanese related to the implementation of the Project,

(8) To follow up the proper operation and maintenance of the facilities provided in the Project. In particular, to conduct the animation activities at the Promotion and the Mobilization Phases before the implementation, and to perform the animation at Follow up Phase after handing over of the facilities constructed under the Project.

(9) To open an account with an authorized foreign exchange bank of Japan immediately after the E/N (Exchange of Note), and to issue P/A (Authorization to Pay) smoothly when it required.

(10) To establish the Project Offices in Accra and Takoradi,

Table 3.1.4. Implementation Schedule



(11) To assign personnel from the CWSA and to pay their salaries,

(12) To bear the local communication expenses of the Project.

3.2. Project Cost Estimation

Based on the undertakings of the Ghanaian side mentioned above, the Project cost to be borne by the Government of Ghana shall be as follows:

Project Cost borne by Ghana	(unit: ,000 Cedi)	
a. Arrangement of Access	500 x 170	85,000.
b. Arrangement of Fence	250 x 285	71,250.
c. Setting of signboard	150 x 242	36,300.
d. Animation cost	1,000 x 350	350,000
e. Office	2,500 x 24	60,000.
f. Personnel	13,500 x 3 x 24	972,000
g. Others	500 x 24	12,000
Total		1,586,550.

Among them, items from a. to c. shall be done by the inhabitants participation, and the cost of d. shall be covered by the inhabitants contribution for initial investment. Item e. does not need actual expense, thus, the actual expenses to be borne by GOG are items of f. and g., total around 984 million Cedi (around 0.2 million US$).

3.3. Operation and Maintenance Costs

3.3.1. Operation and maintenance plan

After completion of the construction works, all of the facilities constructed under the Project are to be handed over to the respective communities, to operate, maintain and manage by them selves through the WATSAN Committee or the WSDB.

The WATSAN Committee is consisted of 7 members at least, and more than half of them are to be women, in general. These 7 persons are:

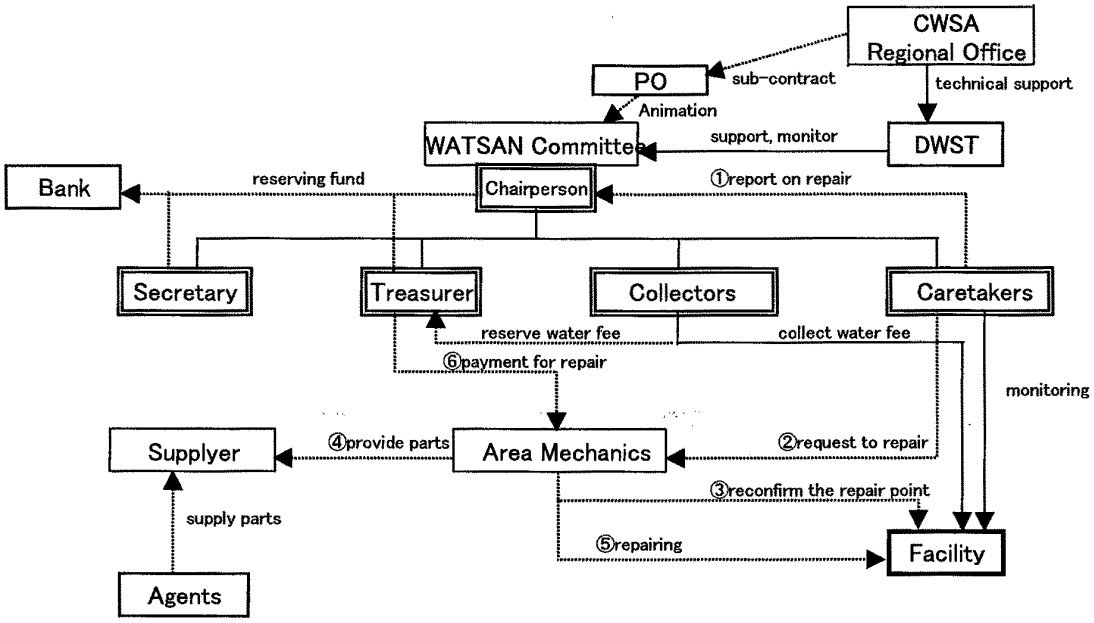
a. Chairperson
b. Secretary
c. Treasurer
d. Collector(s) – depend on the facility number –
e. Organizer
f. Health Organizer
g. Caretaker(s) – depend on the facility number –

In case of the small town having a pipe-borne water supply system, an union of the WATSAN Committees called “WSDB” is to be organized to manage, operate, and maintain the facility, because it has too large population and area to be managed by only one WATSAN Committee. A block of the town represented by a WATSAN Committee has at least one communal tap.

The WATSAN and the WSDB are basically autonomous organization but actually organized through animation activities by a PO under the sub-contract with the RWST. They are educated and trained by the PO, and supported and monitored by the DWST. The

WATSAN Committee shall open a bank account to reserve a 5% of initial investment as a contribution of the inhabitant, before the facility construction. With a help of the PO or the DWST, the Committee shall make up a FMP, and continuously reserve a fund for maintenance. Then, the WATSAN Committee or the WSDB shall operate, maintain, and manage the facility autonomously. They shall reserve the maintenance fund through collecting the water fee, patrol and check the condition of facility, repair the facility if necessary, and replace the pump if required. These operation and maintenance system, after the facility was handed over to the community, is illustrated as Figure 3.1.6.

Figure 3.1.6. Operation/Maintenance Organization



When the system illustrated in the figure is working well and smoothly, the facility can be maintained for a long time, and the sustainability of the Project shall be established. In accordance with the field survey, however, there still be several problems or anxieties on the operation and maintenance system. Those are:

a. An absolute shortage of area mechanics,
b. A shortage of spare-parts suppliers,
c. A chronic shortage of a maintenance fund, because too low water fee,
d. Too late repairs due to the lack of caretaker's technical knowledge,
e. Few times of patrol by DWST, because of lack of transportation means.

To solve the problems and anxieties, the following issues are recommended:

1) For the shortage of the area mechanics and spare-parts suppliers, the CWSA should raise up and promote them further aggressively. At least 2,3 area mechanics should be working in each district. To keep their techniques and to introduce a new technology to them, a periodical technical training for them shall be carried out. For the spare parts supplier, the CWSA should try to organize general stores in the rural area to stock the major spare parts of the pump, as well as to persuade agencies of

pump makers to provide spare parts at the local stores by “pay later” system.

2) Water fee to be collected directly at the water facility or indirectly as per capita should be of enough amount not only for daily maintenance but for full replacement of the pump at 7,8 years interval. For the reason, the CWSA should explain exactly the cost required to operate, maintain, and manage the facility to the WATSAN Committees.

3) A caretaker of the WATSAN Committee is to be educated and trained on the facility and pump by a PO or area mechanics, to enable him to make a daily maintenance. In general, this portion, a daily maintenance and check the condition of pump is the most important routine works for the stability of the facility. Sometimes, it invites a severe repairing when the caretaker missed to recognize a sign of malfunction at an early stage. To avoid such situation, it is quite important to expand the training to the caretakers, for not only level up the knowledge but also to make them able to repair the facility by themselves, providing a set of tools for them. Then, it is recommendable to build up the system that the community can stock some spare parts those need to replace most frequently, if possible.

4) Because of newly established and still small organization, the DWST has poor transportation, nevertheless it needs to contact with communities at most closely. Based on the situation, a motor bicycle to each district shall be provided under the Project, to complement the poor transportation means.

3.3.2. Operation and maintenance cost

1) Level-1 facility

An operation and maintenance cost for the Level-1 facility (borehole with hand-pump) shall be estimated under the conditions listed below:

a. A hand-pump is to be replaced once in ten years (10 % of amortization),
b. A repairing by area mechanics happens once a year, and the cost is to be 7% of the cost of pump,
c. Village level repairing of twice a year are required and the cost is to be 3% of the pump cost,
d. In general, members of the WTSAN Committee are volunteers, but some allowances are paid for the caretakers and the water fee collectors every month,
e. For an operation expense of the WATSAN Committee, 5,000 Cedi/month shall be required.

Based on the conditions, the operation and maintenance annual cost is to be estimated as follows:

Yearly operation and maintenance cost (unit: 1,000 Cedi)

	Vergnet	Afridev	Nira	GMIM-II
Pump replace	840.	780.	450.	2,020.
Repairing	588.	546.	315.	1,414.
Small repair	252.	234.	135.	606.
Caretaker	120.	120.	120.	120.
Collector	120.	120.	120.	120.
Committee expense	60.	60.	60.	60.
Total	1,980.	1,860.	1,200.	4,340.

Thus, around 2,000,000 Cedi for deep borehole pumps (excepting GMIM) and 1,200,000 Cedi for shallow borehole are required, in the case of Level-1 facility, which can serve for 300 people. To recover it as a per capita water fee, it can be calculated as 9,500 Cedi as shown below, under the conditions of 80% of collection rate and 73% of the share of adult (more than 20 years old):

2,000,000 ÷ (300 x 0.73 x 0.8) = 11,415 Cedi/year

It can be converted into 951 Cedi/month per capita. In most of the community, they are collecting water fee around 1,000 Cedi/month per capita nowadays, and it can be evaluated as mostly reasonable. Then, it is converted into a unit water cost of 1.14 Cedi/lit, and it means 20.5 Cedi/bucket (18 lit). It is also conformable to the direct water charge currently collected at most of the community (20 Cedi/bucket and 50 Cedi/tub).

2) Level-2 facility

An operation and maintenance cost for the Level-2 facility (pipe-borne water supply system) shall be estimated under the conditions listed below:

a. A submersible pump is to be replaced once in seven years,
b. A repairing of pump is required twice in the seven years, and the cost is to be 20% of the cost of yearly amortization,
c. The power facility is to be amortized through 15 years (6.7% in a year), and two times of repairing within the period shall be required with the cost same with the yearly amortization,
d. The other facilities such as a tank, pipeline, meters, etc., need maintenance costs from 2,000,000 to 10,000,000 Cedi depending upon the scale of the facility.
e. An electricity charge consists of an unit rate and 30,000 Cedi/month of base charge.
f. In general, members of the WSDB and WTSAN Committees are to be volunteer, but some allowances are paid for a caretaker and water fee collector every month,
g. For an operation expense of the WSDB and WATSAN Committees, 10,000 Cedi/month shall be required.

Based on the conditions, the operation and maintenance annual cost is to be estimated as follows:

Yearly operation/maintenance cost (unit: 1000 Cedi)

	Kikam	Nsuaem	M.Amenfi	Dadieso	Suburi
Facility maintenance					
Pump replace (small)	5,492	10,984		10,984	5,492
Repairing	2,746	5,492		5,492	2,746
Pump replace (large)			12,416		
Repairing			6,064		
Electric facility	1,742	3,484	3,484	3,484	1,742
Repair E.facility	684	1,369	1,369	1,369	684
Other facility	8,000	14,000	12,000	18,000	6,000
Sub-total	18,666	35,333	35,337	39,333	16,666
Management					
Caretakers	1,200	2,400	2,400	2,400	12,00
Collector	3,000	6,600	7,200	8,400	4,200
Administration	1,200	2,400	2,400	2,400	2,400
Sub-total	5,400	11,400	12,000	13,200	6,600
Electricity charge					
Base charge	360	360	360	360	360
Consumption	2,669	5,270	7,483	6,536	3,456
Sub-total	3,029	5,630	7,843	6,896	3,816
Total	27,095	52,363	55,180	59,429	27,082

While, the population, water demand, supply rate, water fee collection rate, etc., are summarized as follows:

	Kikam	Nsuaem	M.Amenfi	Dadieso	Suburi
Population	3,100	6,090	6,500	7,560	4,000
Water supply (m^3/day)	140	275	293	341	180
Demand rate	0.7	0.7	0.7	0.7	0.7
Collecting rate	0.8	0.8	0.8	0.8	0.8
Effective volume (m^3/day)	71	139	148	172	91
Supply duration (day)	365	365	365	365	365
Yearly effective volume(m^3)	25,915	50,735	54,020	62,780	33,215
Unit cost (Cedi/lit)	1.046	1.032	1.021	0.947	0.815
Unit cost (Cedi/bucket)	18.83	18.58	18.38	17.05	14.67

The estimation mentioned above indicates that the direct water charge of around 20 Cedi/bucket is also reasonable in the case of Level-2 facility. And for indirect water charge, per capita water charges for all of the adult person (more than 20 years old) are 998, 982, 969, 897, and 773 Cedi/month for Kikam to Suburi, respectively. That means, 1,000 Cedi/month per capita of water charge is just enough to operate and maintain the facility steadily.

Chapter 4. PROJECT EVALUATION AND RECOMMENDATION

4.1. Project Effect

Current situation and problems

The Project Area, the Western Region of Ghana is one of the most lowly developed areas of the country, ever called as "Pioneer Front". A topographic feature of mountainous area, which has heavy rain, has obstructed the smooth development of infrastructure, represented by a road system. Consequently, the provision of water supply facility was severely delayed, so as to be only 27% of water supply coverage. Although the rural water coverage of Ghana is quite low as 30% in an average (SIP, 1998).

Five Districts out of eleven in Western Region are the target area of the Project. Through the field survey, in the Basic Design Study, it was revealed that more than 75% of the communities in the target districts had no access to proper potable water. Most of the inhabitants must use water from a hand dug well and/or a small pit called as "dugout", or a poor surface water flow sometime. Because of the situation, many people in the area suffer from water-borne diseases such as guinea worm, bilhazia, etc., being obstructed a productive activity and burdening the medical expenses. Traditionally in Africa, to fetch water is the task of women and children. Women who constitute the major economic base in the rural communities spend much time on looking for water during the day. Besides, a school attendance is low especially in a dry season because the children also have to spend hours in searching water, which may cause serious results in the future.

Recently, the Government of Ghana has been promoting to shift all of the water facilities to the community ownership, actually to a WATSAN Committee or WSDB, based on the concept of COM, a key word of CWSP. In the last year, the GWSC that was only one governmental agency responsible for a water and sanitation in the country was separated into two individual organizations; the GWCL of private company operating an urban water supply and the CWSA of governmental agency responsible to a rural water and sanitation. Thus, the water supply development plan shall carefully be formulated taking the conditions of these political and institutional transitions, and a concept of COM, into the consideration.

The Project aims to solve or to mitigate those problems mentioned above, and implements in the five districts in Western Region of Ghana. Project components are to drill around 285 boreholes with hand pump, to construct five pipe-borne water supply systems, and to provide technical assistance by the Consultant as "Soft Components".

Benefit

Through the implementation of the Project, total of 266,100 people in the target communities and small towns shall have a direct benefit, and it will be 22.9% of the total inhabitants of Western Region (1,161,883 in 1998 by SIP). When these people get the access to proper water facility, the service population in Western Region reaches to 571,670 and the water coverage of the Region rises up to 49.2% at a stretch.

Thus, almost half of the inhabitants in the Region shall obtain clean and safe water after the completion of the Project. Not only for good quality but enough volume of water

supply, in combined with the sanitary education conducted through the animation activity, shall reduce the occurrence of water-borne diseases drastically. It assures the maximum productive activity of the rural people, and the minimum level of medical expenditures. For women and children, the heavy burden of fetching water shall be mitigated drastically, and they can shift the time of fetching water to productive and/or housework and going to school.

Such benefits as mentioned above raise the standard of living and sanitation levels of the rural people, aid the agricultural productivity, and improve the rural economy and national economic conditions at last.

Justification as a Japan's Grant Aid

As mentioned so far, the Project is just based on the BHN, to supply water to the rural people. And, this is the phase-IV of the "Project for Rural Water Supply in Ghana" which has been conducted by Japan's cooperation for three times. Although these facts suggest that the Project is to be implemented as planned, the results of evaluation on the appropriateness of the Project to be conducted under Japan's Grant Aid are listed below:

1) Beneficiaries of the Project are the rural inhabitants of the Western Region where is one of the lowest developed Regions of Ghana. Total population of the beneficiaries reaches to 266,100, around 23% of the total population of the Region.

2) The objectives of the Project are to supply clean and safe potable water to the people suffering from water-borne diseases and heavy burden to fetch water, just based on the Basic Human Needs.

3) Animation activities under the Project include educations not only for the water supply facility but for sanitation facility and hygiene. The education on the sanitation, in combined with the provision of clean water, improves the sanitation circumstance of the inhabitants drastically.

4) Now in Ghana, all of the water facilities are shifted to "Community Ownership and Management" under CWSP. The facilities constructed under the Project are to be operated, maintained, and managed by inhabitants themselves through the WATSAN Committee or the WSDB. The Committee, or the WSDB, operates the water facility and collects a water charge directly or indirectly from the inhabitants for a maintenance, repairing and replacement. Thus, the communities can maintain the facilities for long time, without any economical support by the Government or donors.

5) The Project is planed out and going to be implemented under the water sector national plan, CWSP, and in conformable with the current SIP. The Project, thus, contributes to raising the standard of living, activating rural economic activity, and improving national economy, which are the objectives of CWSP. Further, the Project is conformable with the overall national development plan because CWSP is one of the components of "Ghana: Vision 2020".

6) Water supply development plan based on the BHN requires only a little groundwater extraction, and an operation time is also short, hardly influencing on the environment.

While, the borehole for water source of Level-2 facility may lower the groundwater level and dry up the existing borehole facility nearby the hole. However, a pipe-borne water becomes available instead of the hand-pump well, so that the benefit of the people shall not be harmed but improved. The existing borehole facilities shall be remained as they were for an emergency or supplemental use when the Level-2 facility is broken down or maintained periodically.

7) The components of the Project are to construct boreholes with hand-pump and pipe-borne water supply facilities for hard component, and to support animation activities for soft component, just conformable to the items of Japan's grant aid program. Then, all of the techniques, equipment and materials required to implement the Project are established or common. There is no problem for the implementation of the Project.

4.2. Recommendation

Through the implementation of the Project, considerable benefits are expected and they contribute to fulfill the BHN of the rural people drastically, and thus, the suitability to implement the Project under Japan's Grant Aid is confirmed. Furthermore, the facilities to be constructed under the Project shall be owned, operated, maintained and managed by the community, to improve the sustainability of the facilities drastically. The policy reduced the economic and manning burden of the governmental agencies responsible to the Project. However, the Project can be implemented more smoothly and effectively, if the following issues are provided or improved:

1) DWST must be strengthen institutionally and technically.

Under the policy of CWSP, all of the water and sanitation facilities are owned by the communities, then managed, operated, and maintained by themselves. It reduced the burden of the CWSA but increased the burdens of rural organizations for instead, in particular the DWST. The DWST has been just organized and the institutional foundations such as economical, technical and manning resources are deemed not yet established because of its short history. Thus, it is quite important and urgent matter to establish the DWST institutionally, and the technical cooperation of RWST is required further more.

2) Animation activities undertaken by Ghanaian and Japanese sides must be taken over smoothly and completely.

To shift the facility to the community and to make them enable to operate, maintain, and manage the facility, as it has been emphasized repeatedly, it is quite important that the WATSAN Committee is adequately established and not only the Committee members but the inhabitants are properly educated to understand exactly what is the COM. For the purpose, it is also very substantial to conduct animation intensively and carefully at each Project cycle. In the Project, the animation activities in the beginning stages shall be conducted by the Ghanaian side, then by Japan in the middle stages, and by the Ghanaian side again in the follow up stage. Taking over the activity and the discussions on the progress and outputs of the animation at each cycle between the Ghanaian and the Japanese sides are required severely to carry out the animation

without any gap or interruption.

3) 5 % of inhabitant's contribution should be utilized for animation activities undertaken by Ghanaian side.

Prior to the implementation of Japanese Grant Aid Project, the CWSA shall make animation activities for the Promotion and the Mobilization Phases, and continue the animation in the Follow-up Phase after the completion of the Project, by his own expenses. However, it deems rather hard to procure the budgets for these animation activities under the current severe economical conditions of Ghana. Based on the consideration, it should be required to divert the amount of "5 percent of inhabitant's contribution for the initial investment" prescribed in the CWSP, to the fund on the animation activity for the CWSA.

4) The CWSA should raise up and promote the area mechanics and spare-parts supplier.

The area mechanics and spare parts suppliers are very important partners for the WATSAN Committee or WSDB to maintain the facility. Unfortunately, both of them are not satisfactory available in the Western Region right now, and possibly it forms a bottleneck on the smooth operation and maintenance of the facility by the community. By the situation, it is strongly recommended to the CWSA to raise up and promote the area mechanics aggressively, to try to expand the local stores which stock spare parts of the major pumps, and to persuade agencies of pump makers to provide spare parts at the local stores by "pay later" system.

5) A caretaker should be trained to able to repair the facility.

A caretaker of the WATSAN Committee is to be educated and trained on the facility and the pump by the PO or the area mechanics, to enable him to make routine maintenance works. Because of the importance of the maintenance, it is required to step up the training as he can do repairing the pump by himself. To achieve this, it is required to expand the training to the caretakers, not only to level up the knowledge but also to learn the repairing technique of the facility practically, providing a set of tools for them. It is recommendable also to build up the system that the community can stock some spare parts those need to replace most frequently, if possible.