MINISTRY OF HOUSING, CONSTRUCTION & PUBLIC UTILITIES
DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

No. 1

BASIC DESIGN STUDY REPORT
ON
PROJECT FOR IMPROVEMENT OF DRINKING WATER IN THE RURAL AREA
IN
DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

March 1996

JAPAN INTERNATIONAL COOPERATION AGENCY
CHUO KAIHATSU CORPORATION

BASIC DESIGN STUDY REPORT ON PROJECT FOR IMPROVEMENT OF DRINKING WATER IN THE RURAL AREA IN DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA
March 1996

MINISTRY OF HOUSING, CONSTRUCTION & PUBLIC UTILITIES
DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

BASIC DESIGN STUDY REPORT ON PROJECT FOR IMPROVEMENT OF DRINKING WATER IN THE RURAL AREA IN DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

March 1996

JAPAN INTERNATIONAL COOPERATION AGENCY
CHUO KAIHATSU CORPORATION

PREFACE

In response to a request form the Government of the Democratic Socialist Republic of Sri Lanka, the Government of Japan decided to conduct a basic design study on the Project for Improvement of Drinking Water in the Rural Area, and entrusted the study to the Japan International Cooperation Agency (JICA).

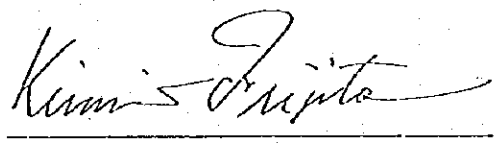
JICA sent to Sri Lanka a study team from January 7 to February 1, 1996.

The team held discussions with the officials concerned of the Government of Sri Lanka, and conducted a field study at the study area. After the team returned to Japan, further studies were made, and as this result, the present report was finalized.

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

I with to express my sincere appreciation to the officials concerned of the Government of the Democratic Socialist Republic of Sri Lanka for their close cooperation extended to the teams.

March 1996



Kimio Fujita
President
Japan International Cooperation Agency

March 1996

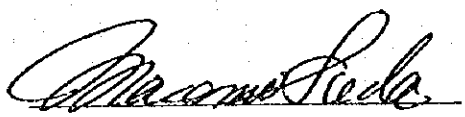
Letter of Transmittal

We are pleased to submit to you the Basic Design Study Report on the Project for Improvement of Drinking Water in the Rural Area in the Democratic Socialist Republic of Sri Lanka.

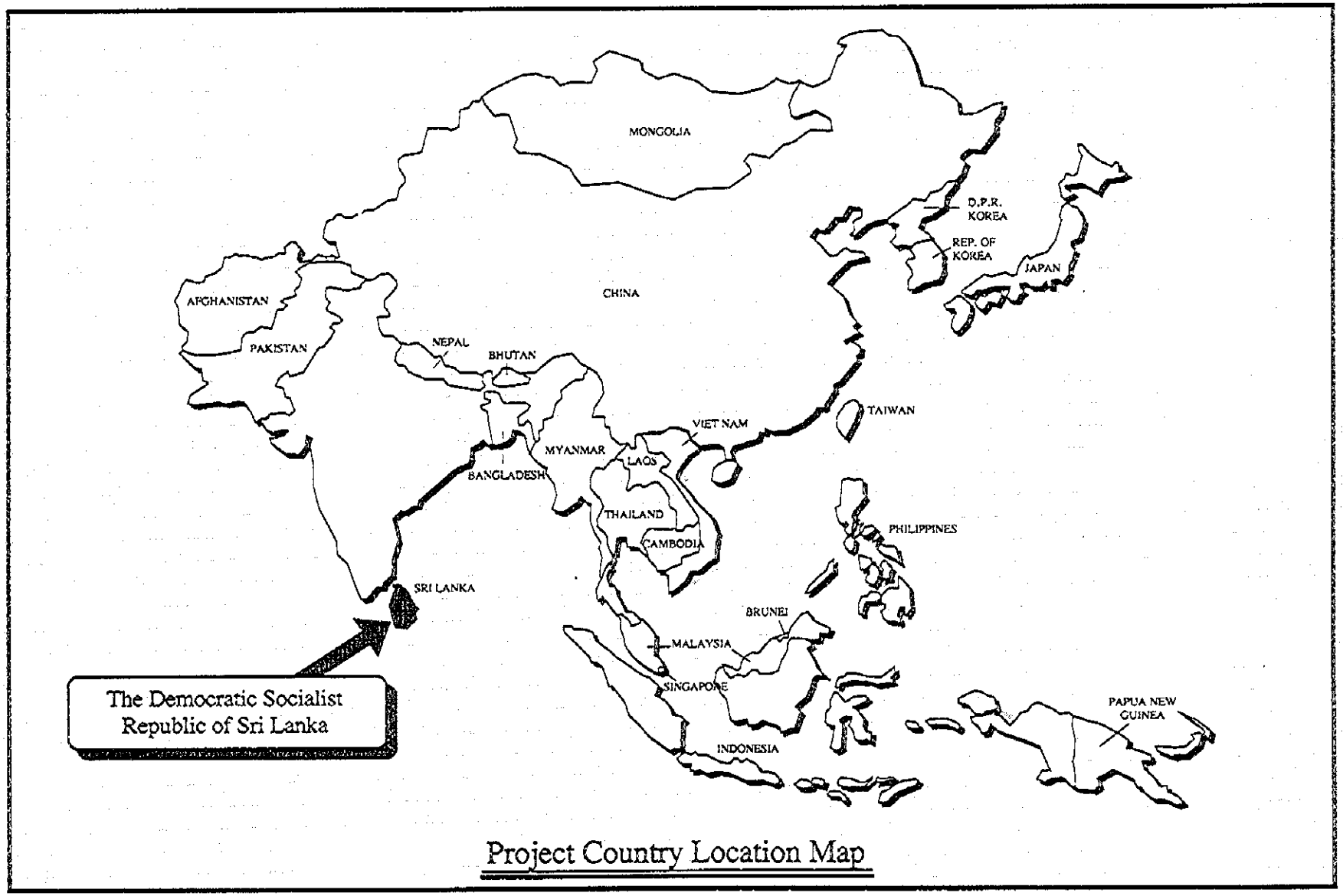
This study was conducted by Chuo Kaihatsu Corporation, under a contract to JICA, during the period from October 19, 1995 to March 29, 1996. In conducting the study, we have examined the feasibility and rationale of the project with due consideration to the present situation of Sri Lanka and formulated the most appropriate basic design for the project under Japan's Grant Aid scheme.

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

Very truly yours,



Masami Suda
Project Manager
Basic Design Study Team on
the Project for Improvement of
Drinking Water in the Rural Area,
Chuo Kaihatsu Corporation



Project Country Location Map

Abbreviations

ADB	ASIAN DEVELOPMENT BANK
B/D	BASIC DESIGN
BHN	BASIC HUMAN NEEDS
CIDA	CANADIAN INTERNATIONAL DEVELOPMENT AGENCY
CIF	*COST, INSURANCE AND FREIGHT*
CWSSP	COMMUNITY WATER SUPPLY & SANITATION PROGRAMME
DANIDA	DANISH INTERNATIONAL DEVELOPMENT AGENCY
E/N	EXCHANGE OF NOTES
ERD	DEPARTMENT OF EXTERNAL RESOURCES
FINNIDA	FINNISH INTERNATIONAL DEVELOPMENT AGENCY
FOB	FREE ON BOARD
GDP	GROSS DOMESTIC PRODUCT
GNP	GROSS NATIONAL PRODUCT
GPS	GLOBAL POSITIONING SYSTEM
GTZ	DEUTSCHE GESELLSCHAFT FUR TECHNICHE ZUSAMMENARBEIT
GW	GROUND WATER
IDWSSD	INTERNATIONAL DRINKING WATER SUPPLY & SANITATION DECADE
IDA	INTERNATIONAL DEVELOPMENT ASSOCIATION
IRDP	INTEGRATED RURAL DEVELOPMENT PROGRAMME
JICA	*JAPAN INTERNATIONAL COOPERATION AGENCY*
JOCV	JAPAN OVERSEAS COOPERATION VOLUNTEERS
MF	MINISTRY OF FINANCE
MHC&P	MINISTRY OF HOUSING, CONSTRUCTION AND PUBLIC UTILITIES
NGO	NON GOVERNMENTAL ORGANIZATIONS
NORAD	NORWEGIAN AGENCY FOR INTERNATIONAL DEVELOPMENT
NWSDB	NATIONAL WATER SUPPLY AND DRAINAGE BOARD
O&M	OPERATION AND MAINTENANCE
ODA	OFFICIAL DEVELOPMENT ASSISTANCE
PO	PROJECT OFFICE
RSC	REGIONAL SUPPORT CENTER
SIDA	SWEDISH INTERNATIONAL DEVELOPMENT AUTHORITY
UNDP	UNITED NATION DEVELOPMENT PROGRAM
UNICEF	UNITED NATIONS FOR CHILDREN'S FUND
USAID	AGENCY FOR INTERNATIONAL DEVELOPMENT(U.S.A.)
VLOM	*HAND PUMP FOR VILLAGE LEVEL OPERATION AND MAINTENANCE*
WHO	WORLD HEALTH ORGANIZATION
WRB	WATER RESOURCES BOARD
-	"GLOBAL CONSULTATION ON SAFE WATER AND SANITATION FOR THE 1990's HELD IN NEW DWLHI"
-	"THE NEW DELHI STATEMENT"
-	PUBLIC INVESTMENT PLAN

TABLE OF CONTENTS

CHAPTER 1 BACKGROUND OF THE PROJECT

The Government of Sri Lanka is currently pursuing the improvement and expansion of potable water supply facilities under its Public Investment Plan for national development. One target of this plan is the establishment of a safe and stable potable water supply for every citizen of the country.

Safe potable water facilities as stipulated in the Public Investment Plan comprise 3 types, i.e. treated pipe borne systems, protected dug wells (enclosed by 2' high concrete wall to prevent intrusion of contaminated water into the well, and equipped with a covered net and a single, permanent bucket for communal use in order to prevent well contamination by unclean buckets), and hand pump operated deep wells. Water supply facilities as of 1992 in this regard are summarized in Table 1-1 below.

TABLE 1-1 STATUS OF WATER SUPPLY FACILITIES IN SRI LANKA

	Dug well		Deep well w/ hand pump*	Pipe borne systems		Traditional water sources / surface water, etc.	Total
	Protected*	Unprotected		Treated*	Untreated		
Nos. of facilities:							
Rural area	525,172	532,683	18,307	182	58	27,773	1,104,175
Urban area	29,233	15,830	6,811	37	0	60	51,971
Total	554,405	548,513	25,118	219	58	27,833	1,156,146
Rural area:							
Benefit household no.	857,804	967,909	182,380	201,597	69,593	156,615	2,435,898
Benefit population	3,989,790	4,974,928	690,563	1,334,562	322,800	732,899	12,045,542
Benefit population ratio	33.0%	41.0%	6.0%	11.0%	3.0%	6.0%	100.0%
Urban area:							
Benefit household no.	44,931	32,000	10,347	159,705	780	2,166	249,929
Benefit population	253,675	187,849	139,831	965,365	3,900	11,064	1,561,684
Benefit population ratio	16.0%	12.0%	9.0%	62.0%	0.0%	1.0%	100.0%
Total beneficiaries							
Benefit household no.	902,735	999,909	192,727	361,302	70,373	158,781	2,685,827
Benefit population	4,243,465	5,162,777	830,394	2,299,927	326,700	743,963	13,607,226
Benefit population ratio	31.2%	37.9%	6.1%	16.9%	2.4%	5.5%	100.0%

* excluding the North-Eastern province, asterik indicates the safe potable water facilities

Source: NWSDB

From the above table, it can be seen that the population percentage benefiting from safe and stable water supply as of 1992 is 49.9% in rural area (6.01 million), 87% in urban area (1.36 million), for a nation-wide total (excluding the North-Eastern Province) of 54.2% (7.37 million).

Within the framework of the "United Nations, International Drinking Water Supply and Sanitation Decade (IDWSSD)" the Sri Lankan government has pursued the establishment of a safe potable water supply for all citizens of the country by 1995. However, this program has fallen substantially behind its originally envisioned schedule, and the foregoing target has been revised to the year 2000 in line with the

"Global Consultation on Safe Water and Sanitation for the 1990's, held in New Delhi in 1990 in conjunction with the above mentioned IDWSSD.

In line with the above, the executing agency for this Project, i.e. the National Water Supply and Drainage Board (NWSDB) of the Ministry of Housing, Construction and Public Utilities, formulated an investment plan for expansion and improvement of the potable water supply in the country over the period 1992~2000. Under the plan, safe potable water supply for the entire population is targeted for the year 2000 through a combination of construction of new facilities and rehabilitation of existing facilities.

With regards to dug wells which comprise one of the safe potable water supply facilities set out above, 1.10 million of these wells have been excavated, and the need for new such wells is dwindling yearly. Instead, the importance of deep wells has grown as a means of responding to water supply needs. The NWSDB has calculated, applying criteria of availability of surface discharge and potential for groundwater development to each district, that construction of 7,500 deep wells will be necessary over the 7 year period 1994 to 2000.

Drilling rigs in the possession of NWSDB for the construction of deep wells total 26 rigs including 13 procured under Japanese Grant Aid in 1983. The majority of these 26 rigs are over 10 years old, and their drilling efficiency has deteriorated with age.

In order to ensure such a water supply for the entire population of the country by the year 2000, an annual deep well construction rate of 1,400 is essential. To accomplish this, existing rigs must be effectively overhauled and new rigs procured. Furthermore, effective operation and maintenance of the existing wells is crucial to sustaining a stable potable water supply. The equipment for this purpose is also needed.

Equipment list requested from NWSDB are shown in Table 1-2 below.

Table 1-2 LIST OF REQUESTED EQUIPMENT

No.	Item	General technical Features	Qty	Priority ranking
1-1	Light rig	w/ down the hole hammer (air hammer [DTH] for revolving drill rig)	1	A
1-2A	DTH-mud drilling rig (A)	mud pump (A), w/DTH compressor	2	A
1-2B	DTH-mud drilling rig (B)	mud pump (B), w/DTH compressor	2	A
1-3	Clay cutter, etc.	Clay cutter, Casing clamp, Shackle	1 set	A
1-4	Tricone bit, etc.	for DTH mud drilling rig (1-2)	1 set	A
1-5	Spare parts	for DTH mud drilling rigs (1-1 and 1-2)	1 set	A
2-1	Air compressor	for existing drilling rigs	4	A
2-2	High pressure washing machine	for maintenance of rigs	5	A
2-3	Maintenance equipment	Jacks and chain block	1 set	A
2-4	Drilling hammer	for DTH	1 set	A
2-5	Button bit	for DTH	1 set	A
2-6	Well flushing units	w/air-compressor	4	A
2-7	Spare parts for existing rigs	for rigs and compressors	1 set	A
3-1	Support vehicle	double cabin, 750 kg load capacity	15	A
3-2	Cargo truck	double cabin, 1,750 kg load cap	10	B
4-1	Water quality field testing equipment	water quality equipment, geophysical survey instrument, pumps and generators	1 set	C
5-1	Hand pump	35m; Indian MK III	1,000	A

CHAPTER 2 CONTENTS OF THE PROJECT

2-1 Objectives of the Project

NWSDB is currently pursuing and program of 7,500 well construction, operation and maintenance for the existing wells to ensure a stable and safe supply of potable water to every household in the country by the year 2000. However, aging of the equipment and lack of rigs have resulted in a drop of construction of wells and maintenance of existing wells. Against the above background, NWSDB has requested cooperation from Japanese government in the procurement of new rigs, spare parts for existing rigs on hand, and equipment for well operation and maintenance.

2-2 Basic Concept of the Project

The equipment for request under the Project as indicated in Table 1-2 of Chapter 1 can be divided into the following 7 categories on the basis of intended use and location of deployment.

(1) New Rig related Equipment

(2) Existing Rig related Equipment

(3) Related Equipment for both New and Existing Rigs

(4) Well Operation and Maintenance Equipment

(5) Support Vehicle

(6) Investigation Equipment

(7) Hand Pump

In order to achieve the above described equipment procurement, the basic concept for the Project framework and categories of equipment is described below.

2-2-1 Framework for Equipment Plan

The basic plan of the Project is the construction of 7,500 new wells over the period 1994~2000. Drilling capacity of current equipment on hand is calculated on the basis of actual achievement in the field to date. Data as a basis for this are the current status of NWSDB rigs as shown in Table 2-1 and rig-wise well construction per annum as indicated in Table 2-2.

Table 2-1 The current Status of HWSDB rigs

Rig no.	*Type*	*Donor*	*Year*	*Equipment status*	*Location of deployment*
DR-1	Atlas Copco	UNICEF	1979/81	under major repair	Anuradapura
DR-2	Atlas Copco	UNICEF	1979/81	in operation	Karutara
DR-3	Atlas Copco	UNICEF	1979/81	under major repair	Anuradapura
DR-4	Tone top 200	Japan	1983	in operation	Karutara
DR-5	Tone top 200	Japan	1983	in operation	Kurunegala
DR-6	Tone top 200	Japan	1983	under major repair	main office
DR-7	Tone top 150	Japan	1984	in operation	Anuradapura
DR-8	Tone top 150	Japan	1984	in operation	Embilipitiya
DR-9	Tone top 150	Japan	1984	in operation	Karutara
DR-10	Tone top 150	Japan	1984	out of order due to accident	main office
DR-11	Tone top 150	Japan	1984	under minor repair	Karutara
DR-12	Tone top 150	Japan	1984	in operation	Matara support office
DR-13	Tone top 150	Japan	1984	under major repair	main office
DR-14	Tone top 150	Japan	1984	in operation	Anuradapura
DR-15	Tone top 150	Japan	1984	out of order due to fire	main office
DR-16	Tone top 150	Japan	1984	in operation	Kurunegala
DR-17	Nemek	NORAD	1985	under major repair	main office
DR-18	Nemek	NORAD	1985	compressor being repaired	Kurunegala
DR-19	Nemek	NORAD	1985	in operation	Moneragala
DR-20	Nemek	NORAD	1985	in operation	Anuradapura
DR-21	Nemek	NORAD	1985	under minor repair	Karutara
DR-22	Nemek	NORAD	1985	retired	--
DR-24	Halco	DANIDA	1986	under major repair	main office
DR-25	Halco	DANIDA	1986	in operation	Anuradapura
DR-26	Halco	DANIDA	1986	under major repair	main office

Table 2-2 Rig-wise well construction per annum

Rig. No.	Type of Rig	Plate No.	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL
DR-01	ATLAS B-80	26/5981	43	86	125	135	112	118	93	100	112	85	35	33	39	89	96	79	29	1,409
DR-02	ATLAS B-80	26/6658	47	132	111	108	122	78	47	19	1	0	2	0	13	0	2	7	13	702
DR-03	ATLAS B-80	28/8014	0	0	0	25	132	117	141	22	128	63	15	8	30	0	0	73	8	762
DR-04	TONE TOP-200	28/8925	0	0	0	0	59	95	113	65	110	80	27	7	26	69	50	50	26	777
DR-05	TONE TOP-200	28/8926	0	0	0	0	66	133	89	99	62	23	14	0	0	0	58	33	39	616
DR-06	TONE TOP-200	28/8927	0	0	0	0	38	109	71	14	0	0	0	0	0	0	0	0	0	232
DR-07	TONE TOP-150	40/5578	0	0	0	0	0	0	75	78	96	60	17	30	22	51	61	51	35	576
DR-08	TONE TOP-150	40/5602	0	0	0	0	0	0	99	87	70	38	18	13	50	8	4	14	20	421
DR-09	TONE TOP-150	40/5603	0	0	0	0	0	0	81	78	84	52	15	15	9	53	50	24	38	499
DR-10	TONE TOP-150	40/5604	0	0	0	0	0	2	20	0	0	0	0	0	0	0	0	0	0	22
DR-11	TONE TOP-150	40/5605	0	0	0	0	0	5	0	54	75	69	0	4	85	38	49	46	18	443
DR-12	TONE TOP-150	40/5606	0	0	0	0	0	0	101	77	61	47	31	18	53	29	17	21	26	481
DR-13	TONE TOP-150	40/5607	0	0	0	0	0	0	92	100	84	65	35	31	15	38	6	31	0	497
DR-14	TONE TOP-150	40/5608	0	0	0	0	0	0	100	66	75	45	10	18	45	42	12	0	18	431
DR-15	TONE TOP-150	40/5609	0	0	0	0	0	0	97	40	58	50	35	0	0	0	0	0	0	280
DR-16	TONE TOP-150	40/5610	0	0	0	0	0	0	80	34	69	59	37	29	19	48	58	41	52	526
DR-17	NEMEK 450B	40/9478	0	0	0	0	0	0	65	35	87	49	47	21	22	0	0	0	0	326
DR-18	NEMEK 450B	40/9218	0	0	0	0	0	0	24	24	23	28	23	15	69	14	0	0	0	220
DR-19	NEMEK 450B	40/9474	0	0	0	0	0	0	14	11	66	32	36	4	23	72	39	40	33	370
DR-20	NEMEK 450B	40/9218	0	0	0	0	0	0	10	16	74	37	26	57	75	60	37	34	12	438
DR-21	NEMEK 450B	40/9477	0	0	0	0	0	0	30	56	65	52	15	50	29	56	44	28	12	437
DR-22	NEMEK 450B	40/9642	0	0	0	0	0	0	23	44	70	55	0	0	0	0	0	0	0	192
DR-24	HALCO	41/4263	0	0	0	0	0	0	0	12	36	0	0	0	0	13	36	22	1	120
DR-25	HALCO	40/7600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	95	70	210
	TOTAL		90	218	236	268	529	657	1,465	1,131	1,506	989	438	353	624	680	664	689	450	10,987

(1) Number of Usable Rigs

Of the rigs currently on hand at NWSDB, those that are operable at present total 19 numbers, comprising (i) 11 (8 presently in operation and 3 more to be available in 1997 after repairs are completed) of the 13 rigs procured under Japanese Grant aid, and (ii) 8 rigs (4 presently in operation and 4 more to be available at the start of 1996 after repairs are completed) provided under cooperation from other donor agencies.

Scheduled numbers of wells to be constructed using existing rigs:

The actual number of wells constructed during 1994 and 1995 by NWSDB amounts to 1,139 as per Table 2-3. The Public Investment Programme prepared by NWSDB aims to construct 7,500 wells for the period of 1994 to 2000, therefore, extra 6,361 wells need to be constructed during 1996 through 2000.

Table 2-3 Actual number of wells constructed during 1994 to 1995, using NWSDB's existing rigs.

Origin of Import	1994	1995	Total
Japanese Grant	311	272	583
Other International Donor Agencies	378	178	556
Total	689	450	1,139

1) Total number of wells expected to be constructed by rigs under Japanese assistance.

The capacity of the existing rigs under Japanese assistance is estimated by the data of NWSDB.

Table 2-4 shows the numbers of wells constructed during the 5 year period (1991~1995) utilizing rigs procured with assistance from Japan.

TABLE 2-4 NOS. OF WELLS DRILLED BY RIGS UNDER JAPANESE ASSISTANCE (1991~1995)

Rig no.	*1991*	*1992*	*1993*	*1994*	*1995*	*Total wells drilled*	*No. of years operated*
DR-4	26	69	50	50	26	221	5.0
DR-5	--	--	58	33	39	130	3.0
DR-7	22	51	61	51	35	220	5.0
DR-8	50	8	4	14	20	96	5.0
DR-9	9	53	50	24	38	174	5.0
DR-11	85	38	49	46	18	236	5.0
DR-12	53	29	17	21	26	146	5.0
DR-13	15	38	6	31	--	90	4.0
DR-14	45	42	12	--	18	117	4.0
DR-16	19	48	58	41	52	218	5.0
Total	324	376	365	311	272	1,648	46.0
					Total effective operating years:		46.0
					Average no. of wells drilled per year per rig:		35.8

Source: NWS

Average no. of wells drilled per year per rig in Table 2-4 is computed by dividing 1,648 total wells drilled by total effective operating 46 years. Three rigs (under repair, accident and burnt) are not included in Table 2-4.

And in the case of the years for which no wells were excavated by a particular rig, it was assumed that the said rig was under repair at the time, and that specific year was eliminated from the calculation.

It is estimated that the 11 rigs procured under previous Japanese assistance will not be completely overhauled until 1997. Accordingly, it is assumed that numbers of Japanese procured rigs actually in operation during FY 1996 will be around 9~10 nos., with total number of wells expected to be constructed in that year computed as follows:

35.8 wells/rig × (9~10 rigs) = 334 wells

As spare parts are scheduled to be procured in 1997 under the Project, rigs in operation during January~June is assumed at 10~11 units, and numbers in operation during the latter part of the year July~December at the full 11 units. Nos. of wells expected to be drilled in this year are:

35.8 wells/rig × (10~11 rigs) = 370 wells

From 1998 at the full 11 units, nos. of wells expected to be drilled in the years are:

35.8 wells/rig × 11 rigs = 394 wells

As a result, it is estimated that total wells constructed by Japanese procured rigs from 1996 to 2000 are 1,186.

1996	1997	1998	1999	2000	Total
334	370	394	394	394	**1,186**

2) Total number of wells expected to be constructed by rigs under assistance from other donors.

Table 2-5 indicates the performance during 1991~1995 of rigs procured with assistance from other donors. On the basis of the table, quantity of annual well excavation from 1996 onwards is assumed at:

49.4 wells / rig × 8 rigs = 395 wells

TABLE 2-5 PERFORMANCE DURING 1991~1995 OF RIGS PROCURED WITH ASSISTANCE FROM OTHER DONORS

Rig No.	*1991*	*1992*	*1993*	*1994*	*1995*	*Total wells drilled*	*No. of years operated*
DR-1	39	89	96	79	29	332	5
DR-19	23	72	39	40	33	207	5
DR-20	75	60	37	34	12	218	5
DR-21	29	56	44	28	12	169	5
DR-25	--	--	45	95	70	210	3
Total	166	277	261	276	156	1136	23

Total effective operating years: 23
Average no. of wells drilled per year per rig: 49.4

Source: NWSDB

3) Total number of wells expected to be constructed by existing rigs of NWSDB.

On the basis of the above estimation, the number of wells that can be expected to be constructed by the year 2000 will be 5,000 shown in table 2-6, which is 2,500 short of the NWSDB target. This will leave around 375,000 persons without soft and stable supply of potable water.

In order to accomplish NWSDB target, existing rigs must be effectively overhauled and new rigs procured.

Table 2-6 Annual number of wells constructed and expected to be constructed by existing rigs (1994 ~ 2000).

Rigs	1,994	1,995	1,996	1,997	1,998	1,999	2,000	Total
from Japan	311	272	334	370	394	394	394	2,469
from other donors	378	178	395	395	395	395	395	2,531
Total	689	450	729	765	789	789	789	5,000

2-2-2 Basic concept of procurement of the equipment

(1) Existing rig related equipment

Air compressors and spare parts for existing rigs and accessories are requested as existing rig related equipment. This equipment is designated for use with the 11 existing rigs currently in operation and which were procured under previous Japanese Grant Aid. Air compressor is essential for constructing wells by rigs. 4 nos. of rig are either without compressors, or are being operated with compressors supplied with assistance from other donors. Accordingly, 4 nos. of this equipment are to be procured.

Quantities of spare parts to be procured are sufficient to operate and maintain the existing rigs procured under previous Japanese Grand Aid, and related equipment for the 4 year period to the year 2000. These spare part items are deemed necessary and justified given the objectives of the Project.

Due to the procurement of air compressors and spare parts, the capacity of the existing rigs is expected to increase as follows.

Spare parts for the 13 rigs procured with Japanese assistance were supplied under the Potable Water Supply Project, 1986. According to the executing agency, rig overhaul was commenced in 1990 using the said parts. Table 2-7 shows the change in numbers of wells drilled per annum per rig before and after overhaul.

TABLE 2-7 COMPARISON OF NOS. OF DRILLED WELLS BEFORE AND AFTER RIG OVERHAUL.

Rig no.	*Before overhaul*		*After overhaul*			
	1989	*1990*	*1991*	*1992*	*1993*	*1994*
DR-4	27	7	26	69	50	50
DR-7	17	30	22	51	61	51
DR-8	18	13	50	8	4	14
DR-9	15	15	9	53	50	24
DR-11	0	4	85	38	49	46
DR-12	31	18	53	29	17	21
DR-13	35	31	15	38	6	31
DR-14	10	18	45	42	12	0
DR-16	37	29	19	48	58	41
Total	190	165	324	376	307	278

Average no. of wells excavated yearly before rig overh	177.5
Average no. of wells excavated yearly after rig overhau	321.2
Increase increment for well excavation after overhaul	1.8 fold

Source: NWSDB

On the basis of the above, it is concluded that the increases increment in number of wells excavated during the 4 year period 1991~1994 following procurement of spare parts and overhaul is 1.8 fold. The annual capacity of existing rig is 394. The number of wells which can be expected to be excavated by existing rigs per year after procurement of spare parts would be:

$$1.8 \times 394 \text{ wells} = 707 \text{ wells}$$

It is assumed that the results of spare parts procurement will begin to become evident after June 1997, with an increase increment for that year expected to be around 150 (half of the total increment per year). It will be increased 1,095 well constructions from 1997 to 2000 by procurement of air compressors and spare parts.

Total well excavation quantity per existing rig will be 64 (normal quantity plus incremental amount), which is roughly 85% of the excavation amount to be achieved by each new rig. However, in order to sustain this performance over the four year period will require a thorough and carefully followed inspection and maintenance procedures for equipment.

In addition, operation and maintenance tools for rigs, drill hammer and bits are essential for well excavating, and to be procured 4 years operating quantities.

(2) New rig related equipment

The total nos. of wells to be expected by the existing rigs from 1997 to 2000 will be 1,095 by means of procurement of spare parts. However, it is 1,405 wells short of the NWSDB target by the year 2000. To achieve NWSDB target, new rigs are procured.

Table 2-8 indicates yearly excavation by 13 rigs procured under the Potable Water Supply Improvement Project, 1983 for the 5 year period immediately after procurement when the equipment was still relatively new. On the basis of the table, it can be assumed that each new rig will be capable of drilling 75 wells per year for the 4~5 year period immediately after procurement.

TABLE 2-8 ANNUAL WELL EXCAVATION BY THE EXISTING JAPANESE PROCURED RIGS IMMEDIATELY AFTER PROCUREMENT

Rig no.	*1984*	*1985*	*1986*	*1987*	*1988*	*Total wells drilled*	*No. of years operated*
DR-4	95	113	65	110	80	463	5
DR-5	133	89	99	62	23	406	5
DR-6	109	71	--	--	--	180	2
DR-7		75	78	96	60	309	4
DR-8		99	87	70	38	294	4
DR-9		81	78	84	52	295	4
DR-11		--	54	75	69	198	3
DR-12		101	77	61	47	286	4
DR-13		92	100	84	65	341	4
DR-14		100	66	75	45	286	4
DR-15		97	40	58	50	245	4
DR-16		80	34	69	59	242	4
Total	337	998	778	844	588	3,545	47
Average no. of wells drilled per year per rig:							75

Source: NWSDB

(3) Equipment for use with both existing and new rigs

Field survey by the Study Team indicated mud caking on interior parts of the rig, causing rusting and wear of steel components of the equipment. As the interior parts of the rigs cannot be effectively cleaned by hand, the high pressure washing machine is deemed necessary for procurement.

(4) Well management equipment

Well flushing equipment is to be used to clean wells in the course of maintenance and rehabilitation activities, thereby relieving screen clogging and enabling pump-up volumes to return to design levels. Well flushing is necessary under the 3 tier maintenance system, and this equipment is accordingly deemed appropriate for procurement under the Project. Nos. of units to be procured will take into consideration present numbers of wells and existing flushing equipment on hand.

The cargo truck was requested for well O&M activities, and are intended to be deployed primarily at the regional support centers under the Operation Division of NWSDB. Types of vehicles are determined on the basis of compatibility with existing such equipment already in hand. Quantity of equipment to be procured is determined with reference to numbers of such units already deployed at the various offices.

(5) Support Vehicle

Support vehicles were requested for O&M of both new and existing wells, and for transport of personnel and equipment between the central office and project offices. However, it is concluded that the various offices already have on hand sufficient such equipment for O&M of existing wells and transport between offices; and accordingly, scope of procurement for this item will be support vehicles for new well O&M only.

(6) Survey Equipment

This equipment has been requested for use at the Investigation Section of NWSDB. As can be seen from Table 2A-11 (p. 2-50), physical prospecting equipment has been procured previously under Japanese Grant aid, however, additional equipment has been further requested under this Project due to the fact that NWSDB has indicated that previous equipment is to large and cumbersome to be effectively transported to remote and difficult drilling sites. Nevertheless, results of field survey indicated that the said equipment is in good functioning order, and in principle equipment of this type is therefore be excluded from consideration under the Project. However, survey equipment to be utilized during actual well drilling operations will be considered within the scope of procurement of the Project. This will comprise water quality testing equipment in light of the problem of high fluorine content in groundwater which has been emphasized by UNICEF as posing a potential health threat.

Pumps and generators have been requested for pumping tests at wells to be equipped with pumps. However, the subject Project is focused primarily on the construction of hand pump operated wells, and thus equipment intended solely for use at wells to be pump operated is considered to be outside the spirit of the Project and these items have therefore been eliminated from consideration under this Project.

(7) Hand Pumps

Number of hand pumps sufficient for installation at the wells to be constructed during FY 1997 are to be procured under the Project.

(8) Other Equipment

At the time of field survey by the Study Team, the executing agency requested that sludge pump and defluorination equipment not be included under the Project. As sludge pumps have already been procured, elimination of this item from consideration is deemed appropriate.

In the case of defluorination equipment, the need for this item is recognized in light of the fact that there are areas of high fluorine content in groundwater in Sri Lanka as per the concern expressed by UNICEF. However, this type of equipment cannot be easily maintained at the village level due to the impossibility of parts and material procurement. Furthermore, the executing agency is in the process of developing a simple type defluorination device which has reportedly shown promising results during experimental use. This equipment will be inexpensive and necessary procurement to operate and maintain the same can be done at either the executing agency or village level. Accordingly, the decision to eliminate this item from the scope of procurement under the Project is deemed appropriate.

2-3 Basic Design

2-3-1 Design Concept

(1) Natural Conditions

As discussed previously, 1.1 million dug wells and 25,000 deep wells have been constructed in Sri Lanka as of the present. However, suitable sites for dug wells have steadily been depleted, and demand for deep wells has proportionally increased. With the increased demand for deep wells, prospective sites become more and more technically challenging including sites on alluvial formation in which DTH has a relatively high well failure rate, sites with difficult access and sites where the groundwater table is located in deep ground.

Up to this time, well depth has generally been around 60 m. However, given conditions of thick overburden and groundwater table being located in deep ground, it is expected that there will be an increasing need to drill wells to the 100 m depth range. Also, since alluvial formation is anticipated to yield a large volume of water, wells in such sites can respond to large consumption requirements at hospitals, schools and other public facilities. Accordingly, rigs to be procured must be able to excavate large diameter well shafts (around 10" dia.) to be equipped with submersible pump.

Also, it is important that equipment to be procured is resistant to hot and wet climate in view of the tropical climate of the Project areas and the extremely high humidity occurring during the rainy season. It is also necessary that spare parts be packed such that they are not adversely affected by the aforementioned climatic conditions.

In light of the above, criteria with regards to natural conditions for equipment to be procured are as follows:

① Equipment is suitable for sites with poor access.

② Equipment can be effectively used in alluvial formation.

③ Equipment is suitable for drilling in bedrock.

④ Equipment is suitable for drilling works to 100 m depth.

⑤ Equipment is capable of drilling well shafts of 10" dia.

⑥ Equipment can tolerate tropical climate.

⑦ Equipment has been moisture protected for storage in tropical climate.

(2) Social Conditions

There are no social constraints to the construction of wells. However, attention must be given to security in well site areas due to the continuing ethnic strife in the country. It would be recommendable to carry out subsequent detailed design works primarily at the NWSDB head office in Ratmalana given the danger in crowded districts of the capital. Under future implementation of the Project, the procedure for check of equipment during and after customs procedures at Colombo port would be requested of the Sri Lankan side. Also, scope of work for delivery of equipment on the part of contractors would be CIF Ratmalana, with contractor delivery responsibility to end with handing over of equipment at Ratmalana.

It is the policy of NWSDB to procure hand pumps which can be operated and maintained at the village level (VLOM) in line with the expanding program of 3 tier O&M. Accordingly, hand pumps to be procured will be models with proven performance with regards to said O&M at the village level. Specifically, the Indian model MK III encouraged under donor assisted projects is considered appropriate. On the basis of the foregoing, criteria with regards to social conditions for equipment to be procured are as follows:

① Execution of detailed design under the Project is to center on Ratmalana near Colombo.

② Check of equipment during and after customs procedures at Colombo port would be requested of the Sri Lankan side. Final check of equipment would be performed at Ratmalana.

③ Hand pumps to be procured are to be of the VLOM type, suitable for 3 tier O&M.

(3) Local Contractors and Local Equipment

There are only 3 civilian contractors, all with head offices in Colombo, which are engaged in well drilling works in Sri Lanka. During the period 1992~1994, share of total groundwater development works accounted for by these private contractors is 9~10%, and this percentage has remained constant over recent years. Private contractors have been engaged in well construction for a variety of clients including hotels, manufacturers, private citizens, commercial farmers, etc. as opposed to NWSDB well construction which has been on a larger, project basis. Accordingly, procurement of well drilling equipment by NWSDB will not impinge upon the operations of these private firms. During the field survey under the Study, the Team visited the aforementioned 3 private contractors to discuss the situation of competition in well construction with NWSDB, and all 3 indicated that rig procurement by NWSDB would have no impact on their operations. Also, as their are no firms in the private sector in Sri Lanka which specialize in well operation and maintenance activities, NWSDB will be the agency responsible for well O&M in the targeted Project areas.

In Sri Lanka, air compressors for use with DTH, drill hammers, tricone bits, high pressure well cleaning machines, drill accessories such as jacks, clay cutters, hand pumps etc. are generally available on the market. These items are handled by well established agents with spare parts readily procurable and good after sales service. They will be to be procured from a third country on condition that the marketing agent can follow up with spare parts and after sales service where necessary.

The Mark III hand pump recommended under the Project is manufactured by over 100 different companies in India. Criteria in selecting the manufacturer shall be that he has an established agent in Sri Lanka, and, to ensure suitable quality, produces a pump of the type recommended by UNICEF. As UNICEF recommends the product of more than 10 firms, impartiality can be achieved through tender. On the basis of the above, criteria with regards to use of local contractors and procurement of local equipment are as follows:

① NWSDB performs well construction and O&M of the wells.

② A portion of equipment is to be procured locally or from a third country.

(4) O&M Capability of Executing Agency

As discussed earlier, the operational and maintenance capabilities of the executing agency are judged to well adequate for the implementation of the Japanese Grant Aid type project in terms of technical levels and management capability. Although the executing agency does not have experience to date in mud drilling, its engineers are currently undergoing training with the cooperation of UNICEF and the Water Resources Board. Arrangements are also being made by NWSDB to appropriately expand its budget to cover personnel costs for new drilling engineers to man its fleet of rigs to be increased under the Project.

In addition to record keeping by log book, it is considered necessary that computer management of spare parts stockages be introduced. Manufacturers should also be encouraged to deliver equipment in a manner most suitable to store management under NWSDB's system. Furthermore, a well excavation cost should be set which includes depreciation of equipment in order that the executing agency can embark on a sustainable program of spare parts procurement with its own resources. On the basis of the foregoing, criteria with regards to O&M capability of the executing agency are as follows

① Equipment is to be procured which generally is well familiar to NWSDB engineers in terms of O&M.

② New technology including mud drilling, etc. is to be adopted after confirming proper arrangements for engineering staff to support the same.

③ In order to foster independent procurement of spare parts by the executing agency, maximum emphasis will be given to procurement of equipment under the Project for which spare parts are available in Sri Lanka.

④ Spare parts suppliers will be required to attach photos of items with their deliveries so that the store keepers, who in some cases do not have a technical background, can readily confirm the content.

⑤ Packing of spare parts is to be one item per package so confusion of items does not occur.

⑥ Equipment to be procured is to be as simple as possible in order to facilitate O&M.

⑦ Equipment to be procured is to be compatible to the extent possible with existing equipment on hand at the executing agency.

⑧ Manufacturer for the MK III is to be selected from among firms recommended by UNICEF.

(5) Equipment Scope and Grade

Scope and grade of equipment to be procured under the Project is to be such that, in combination with existing equipment at NWSDB, the target of constructing 7,500 by the year 2000 can be achieved, while at the same time effectively maintaining and operating existing wells.

Accordingly, quantities of supplementary equipment (spare parts, compressors) for existing rigs will be kept to a minimum and the scope of this procurement will be for the rigs procured under previous Japanese Grant aid only.

With regards to new rig and related equipment, scope and grade of equipment will be determined so as to be quantitatively compatible with the components and objectives of the Project.

A detailed examination of each type of equipment is included in the subsequent section on Equipment Plan.

Accordingly, on the basis of study to date, the strategy for determining grade and scope for procurement of equipment is indicated below.

1) Nos. of air compressors to be procured for existing rigs will be sufficient to meet the needs of operating these rigs in combination with existing compressors on hand.

2) In the case of spare parts for existing rigs, redundancy with present spare parts inventory will be avoided. Quantity and types of parts to be provided will be aimed at keeping the existing rigs operable until the year 2000, which is considered the expiry of the expected utility life of the equipment.

3) Five nos. of new rig are to be procured. These are aimed for use at sites of poor access and sites located on thick alluvium deposits. These rigs are to be capable of drilling to 100 m depth.

4) Tools and consumable parts for new rigs are to be procured in quantities sufficient for 2 years operation of equipment.

5) Spare parts for new rigs are to be procured in principle in types and quantities for 2 years operation of equipment; however, where appropriate, certain spare part items will be selected on the basis of importance to equipment operation rather than whether or not they will be needed for replacement after 2 years of operation.

6) Only survey equipment to be used directly at the well construction site during drilling is to be considered under the Project. This will comprise the water quality testing equipment given the concern for high fluorine content of groundwater is some areas of Sri Lanka.

7) Hand pumps are to be procured in a quantity sufficient to equipment wells newly constructed in FY 1997.

8) Well management equipment will be subject to procurement under the Project; however, quantities will be compatible with nos. of such equipment already on hand at NWSDB.

9) Cargo trucks will be procured in a quantity compatible with the current status of such equipment deployment at the various offices.

10) Five numbers of support vehicle will be procured to accommodate the work teams for the 5 new rigs to be procured under the Project.

(6) Implementation period

The Project implementation period will fall within a single fiscal year as the longest time required for procurement of any single item is around 4 months (new rigs)

2-3-2 Basic Design

Equipment to be procured under the Project will be deployed to the central office, 5 project offices, and the regional support centers at Matara and Hambantota under NWSDB which serve as the base for implementation of the various water supply related projects under the Public Investment Plan. Security at these offices is good, and they have under their jurisdictions project areas for national level projects, and in this regard are considered to be suitable sites for deployment of the equipment under the Project. Specific equipment to be deployed at each of the subject offices is as follows:

(1) Overall Plan

Deployment locations for the equipment under the Project are as follows.

① Central office of NWSDB (outskirts of Colombo)

- Light rig: For use at sites of poor access; to be deployed to project offices where necessary.
- Spare parts for new rig: Spare parts to be procured for new rigs are to be under central management at the central office, with deployment of the same to the project offices as required.
- Spare parts for existing rigs and support vehicle: To be stored and managed in the same manner as for the above spare parts for new rigs.
- Spare parts for hand pump: These as well are to be centrally managed at the central office, with deployment to the regional support centers and local government entities as required.

The above equipment requires no special installation procedures, and the capacity to store and maintain the same is well within the capacity of the central office based on past performance to date. The above deployment is thus considered appropriate.

② 5 project offices under the Groundwater Section (Anuradhapura, Kurunegala, Monaragala, Embilipitiya, Kalutara)

- DTH · mud drilling rigs and compressors
- High pressure washing machine; repair equipment (jack, chain block)
- Drill hammers and bits
- Field water quality testing equipment

The above comprise standard equipment with which the designated offices for deployment are familiar, and can be effectively operated with the present facility status of the offices. Deployment to the same is accordingly considered appropriate.

③ Regional support centers (Matara, Hambantota)

- Well flushing equipment (1 unit at Matara)

- Cargo truck (at Hambantota)

The above equipment is necessary for maintenance of existing wells under the 3 tier system. The designated locations function in effect as branches of the project offices and therefore are considered appropriate locations for deployment of the above equipment.

④ Well construction sites

- Hand pumps (after completion of well construction)

These are deployed to the well site for installation upon completion of well construction and are to be operated and maintained at the village level.

The above equipment deployment will not require the installation of any additional equipment or facilities. Deployment locations are considered suitable given the past performance of the Groundwater Section of the NWSDB.

As the deployment locations are located throughout Sri Lanka, the Groundwater Section of NWSDB would assume responsibility for initially receiving all procured items, and then forwarding the same to the designated locations of deployment.

Confirmation of delivered quantities of equipment and division of the same into appropriate lots for transport to deployment locations would likewise be done at the Groundwater Section's head office.

The store house at Telawala currently used for scrap parts will be made vacant next year, and this facility will be will be appropriate for temporary housing of the equipment to be procured under the Project. Space is also available for parking of trucks and other vehicles, and security by guard is in place.

(2) Equipment Plan

The equipment plan under the Project, based on the criteria discussed in the previous section, is as follows.

1) Light duty rig

The vehicle mounted rig is necessary for drilling works in sites of poor access. It will be deployed at the head office, for dispatch to the project offices as needed. Procurement of this equipment is justified by the increasing demand for well construction in areas of difficult access, as areas of easier access have been largely covered under previous well construction to date.

Basic specifications for this item are that it is capable of 6 inch diameter well shaft excavation to a depth of 100 m, with use of the standard DTH specification

applicable in Sri Lanka. The rig will come with large type tractor for transport into sites in difficult terrain. One number of tractor mounted, light duty rig is to be procured as requested.

2) Combination DTH · mud drilling rig (large capacity type)

Deployment of this equipment will be at the project offices of Anuradhapura and Embilipitiya as per the executing agency's request.

These two areas contain a combination of locations with thick and thin overburden. The conventional DTH method of drilling is suitable for sites with thin overburden; however, at sites of thick overburden or with mud, sand and gravel deposits in flood plain, the mud drilling (rotary) method is recommended to prevent collapse of the well shaft wall. Due to the aforementioned variance in natural conditions at well construction sites, the combination DTH · mud drilling method is to be adopted for well construction.

Rigs are to be capable of 10 inch diameter drilling to a depth of 100 m. As ground water table is deep in the Anuradhapura and Embilipitiya areas due to their location in dry zone, the large capacity type mud pump is to be selected. The mud pump will be trailer mounted. Specifically, mud pump capacity will be 1,000 liters/min, 24 kg/cm^2.

Rigs will be capable of 14 inch diameter drilling to accommodate 10 inch diameter casing, enabling the construction of hand pump operated deep wells in alluvial formation, and production wells up to 10 inch diameter. Mud pump is to be trailer mounted.

Air compressor to be used with the DTH will be compatible with equipment already on hand and of comparable capacity (17 m^3/min, 12 bar). The compressor will likewise be trailer mounted.

3) Combination DTH · mud drilling rig (medium capacity type)

As per the executing agency's request, this equipment will be deployed to the Kurunegala and Monaragala project offices where demand for well construction is high. Due to the differing topographical and geological conditions of the areas under the jurisdiction of these two offices, it is desirable that the combination DTH · mud drilling type rig be deployed thereat.

Rigs are to be capable of 10 inch diameter drilling to 100 m depth.

As drilling depth in the Kurunegala and Monaragala areas is generally to around 50 m depth, the medium capacity mud pump is to be selected. This takes into consideration as well the fact that access by heavy trailer into the widespread mountainous terrain of both areas is difficult. Although more time is required, the medium capacity type is capable of drilling to 100 m depth where required to tap into deep ground water tables. Specifically, mud pump capacity is to be 750

liters/min, 19 kg/cm², and pump is to be trailer mounted.

Rigs will be capable of 10 inch diameter drilling to accommodate 6 inch diameter casing, enabling the construction of hand pump operated deep wells in alluvial formation which has heretofore been difficult with equipment on hand. Mud pump is to be trailer mounted.

Air compressor to be used with the DTH will be compatible with equipment already on hand and of comparable capacity (17 m³/min, 12 bar). The compressor will likewise be trailer mounted.

4) Clay cutter and other rig accessories

Clay cutters, casing clamps and jacks will be procured in quantities of 6 nos. each. These are necessary for mud drilling with the above rigs. One unit of each will be deployed to each rig deployment location. As this will be NWSDB's first experience with this type of drilling, 2 units each will be stocked in reserve at the head office. Equipment capacity will be appropriate for the above described rigs.

5) Tricone bits

Tricone bits are essential for mud drilling. Tricone bits will be quantities to operate for a period of 2 years. Criteria in determining quantities of the same are as follows:

Yearly number of wells to be excavated per year:	75
Nos. of rigs:	4
Mean drill depth per well:	50 m
Mud drilling ratio:	20%
Period to be covered by procurement:	2 years
Total drill depth:	6,000 m
Utility life of tricone bit:	150 m / 1 unit
Nos. of bits required per rig:	40

Six types of tricone bit have been requested. Required nos. of bit per rig is 1.67, and accordingly 2 units of each of the 6 types will be procured.

6) Spare parts for new rigs

Scope of spare parts procurement is targeted at the above mentioned light rigs, combination DTH · mud drilling rig (large and medium capacity types), rig

compressors (for light, and combination DTH · mud drilling rigs), mud pumps for combination DTH · mud drilling rigs, DTH's for rigs (for light, and combination DTH · mud drilling rigs), and tractors for rig mounting (for light, and combination DTH · mud drilling rigs). In principal, spare parts will be provided in quantities sufficient for 2 years operation of rig equipment; however, it is anticipated that such important parts as piston rods for engines, crank pins and valves for hydraulic equipment will be necessary after the elapse of the said 2 year period, and these will be procured in quantities based on perceived necessity rather than on a criterion of a set period of equipment operation. Percentage of spare parts consumption is estimated at 33% in the first year, 50% in the second year and 33% in the third and subsequent years.

Spare parts for regular maintenance and extreme emergencies will be deployed to the project offices. Other spare parts would be maintained collectively at the central office. Spare parts procurement will be based on an overall procurement per group of equipment rather than a set quantity per unit of equipment, as items are to be centrally stored and managed for deployment as required. For example, in the case of the 4 combination DTH · mud drilling rigs to be supplied, instead of procuring one set each of spare parts for each unit of the same, and appropriate quantity of spare parts as one lot to maintain the equipment for the designated period would be procured.

7) Air compressor

This item is for the existing rigs, and will replace the current superannuated equipment. The present operational status of compressors was confirmed by the Team in the field. Of the 11 rigs procured under previous Japanese Grant Aid and still operable, rig nos. DR-5, DR-6, DR-8 and DR-16 are either without compressors, or are being operated with compressors supplied with assistance from other donors. Accordingly, 4 nos. of this equipment are to be procured under the Project.

As wear and tear on the compressor equipment is relatively high compared to rig equipment. In order for interchangeable use with existing compressors, capacity will be the same 17 m^3/min, 12 bar. Compressors will be trailer mounted for transport to drilling sites by rig or support vehicle.

8) High pressure cleaning machine

This equipment is to be used for rig cleaning. Field survey by Team indicated rusting of rig rotary tables, and it is concluded that use of this equipment will significantly prolong rig utility life. The equipment has been requested for deployment to Anuradhapura, Kurunegala, Monaragala, Kalutara and Matara. Matara is a regional support center under the Operations division of NWSDB, and Embilipitiya is a project office under the Development division. Although the affiliations of these offices within NWSDB are different, there is a close operational link between the two. Accordingly, deployment of the equipment at Matara will in effect mean its deployment as well at Embilipitiya. The high

pressure cleaning machine is equipped with an air compressor, and is capable of cleaning caked mud and dirt from the rig.

9) Repair equipment

Five nos. of jack and 10 nos. of winch block have been requested for rig repair and overhaul works. The jack is used to raise the rig during repairs, and accordingly will have a capacity of 20 t considering the fact that the heaviest rig equipment on hand at present is 14~16 tons. The chain block is mainly used to remove parts from the rig mast and is to be 2 ton capacity to accommodate the mast weight. Location of deployment will be the 5 project offices at Anuradhapura, Kurunegala, Monaragala, Kalutara and Matara.

10) Drill hammer

This has been requested for use with the new rigs to be procured under the Project. As this is a consumable item, a two year supply for new rigs and 4 year supply for existing rigs will be procured.

No. of wells drilled per year by each new rig:	75
No. of years of operation per rig:	2 years
No. of new rigs:	5
Average drill depth:	50m
DTH ratio:	80%
Total drill depth (4 year period):	30,000 m
No. of wells drilled per year by each existing rig:	65
No. of years of operation per rig:	2 years
No. of existing rigs:	11
Total drill depth (4 year period):	143,000 m
Grand total for drill depth:	173,000 m
The utility life of drill hammer	2,000m/unit
Number of units required	86.5 units

The request from the Sri Lankan side is for 85 nos. and this is considered appropriate. This equipment would be deployed as per the request to the locations in Table 2-9. Current stocks of Cop 62 and Cop 42 bits on hand at NWSDB total

280 nos. and these have not been utilized due to not having the corresponding drill hammer item.

TABLE 2-9 QUANTITIES OF DRILL HAMMER AND LOCATIONS OF DEPLOYMENT

	100-275 mm	105~150 mm	127~165 mm	Cop 62	Cop 42
Anuradhapura	3	6	7	1	3
Kurunegala	3	8	8	1	3
Kalutara	2	8	7	1	2
Embilipitiya	1	5	5	1	1
Matara	1	3	3	1	1
Total	10	30	30	5	10

11) Bits

This is a consumable item used in drilling operations. Applying the same calculations as for the drill hammer above, total well drill depth to be considered in determining quantities of bits to be procured is 173,000 m. As button bits have a utility life of 300 m, 577 units are necessary. At present, there are 260 units on stock at NWSDB. Accordingly, another 317 units are required. The Sri Lankan side has requested 308 units and this is considered appropriate given its close approximation to the foregoing figure. Quantities and locations of stocking for this item area as indicated in Table 2-10.

TABLE 2-10 QUANTITIES AND LOCATIONS OF STOCKING FOR BITS

	105 mm	165 mm	203 mm	254 mm	127 mm	115 mm	191 mm
Anuradhapura	12	12	2	2	14	20	7
Kurunegala	12	12	3	2	15	20	7
Kalutara	12	12	3	2	15	30	8
Embilipitiya	7	7	1	1	8	15	4
Matara	7	7	1	1	8	15	4
Total	50	50	10	8	60	100	30

12) Well flushing equipment

Well drilling performance district-wise by NWSDB is indicated in Table 2-17 for the period 1980~1995.

Nos. of wells constructed in districts of jurisdiction and status of well flushing

equipment for each project office are shown in Table 2-11.

TABLE 2-11 NOS. OF WELLS CONSTRUCTED IN DISTRICTS OF JURISDICTION AND STATUS OF WELL FLUSHING EQUIPMENT FOR EACH PROJECT OFFICE

Project office	*Nos. of wells*	*%*	*Well flushing equipment on hand*	*Requested nos.*
Anuradhapura	2,576	38.1	1	2
Kurunegala	1,339	19.8		1
Monaragala	1,244	18.4	1	
Embilipitiya	928	13.7	(used jointly with Monaragala)	1
Kalutara	678	10.0		
Total	6,765	100.0		

Source: NWSDB data

As almost 40% of the existing wells are within the jurisdiction of Anuradhapura project office, this office needs some well flushing equipment. However, given the fact that a single piece of equipment costs, and with consideration to subsequent O&M costs and equipment depreciation cost, it was decided to limit procurement for the Anuradhapura project office to 1 unit.

In the case of the Kurunegala project office, request for 1 unit of the equipment is considered appropriate given the fact that it currently has no such equipment on hand, yet has around 20% of total wells within its jurisdiction. At present, the Embilipitiya project office using equipment jointly with the Monaragala project office for well flushing. Since the 2 project office jurisdictions account for over 30% the total wells, it is considered justified under the Project that 1 unit of the equipment be procured for the Embilipitiya office. For the Kalutara project office, no request for equipment was made and this is judged appropriate given the low number of wells under its jurisdiction. Thus, in response to request for 4 units of well flushing equipment, it was decided under the Project to procure 3 units. Specifications are 4 ½ inch diameter and depth capability of 50 m. This equipment consists of carrier truck, air lift, air compressor, hoist, and etc.

13) Spare parts for existing rigs

In line with the Project strategy, spare parts for existing rigs are to be procured in quantities sufficient for operation to the year 2000. However, it is also necessary to avoid redundancy with spare parts stocks on hand. Status of current stocks of spare parts is summarized in Table 2-12.

TABLE 2-12 CURRENT STATUS OF SPARE PARTS ON HAND

Name of Parts	*In*	*Out*	*No. of Intently*
Bearing	439	121	318
Packing Seal	7,227	4,188	3,039
Bulb Switch	607	367	240
Gauge, Meter	333	267	66
Spring	2,061	1,643	418
Vehicles (Hino)	7,151	2,952	4,199
(Inner Bolt and Nut	4,093	1,259	2,834)
Vehicles (Toyo Unpanki)	1,592	859	733
Compressor	2,949	2,713	236
TOTAL	22,359	13,110	9,249

On the basis of confirmation through field survey alone, 9,000 units of spare parts have been identified on hand at NWSDB. Bearings, packing seals, and nuts / bolts for vehicles are in stock in large quantities. On the other hand, consumption of oil elements, etc. for regular maintenance is high. Selection of spare parts items for procurement will take the foregoing into account, in order to maximize effective procurement of truly necessary items.

A. Suppliers of spare parts will be instructed to affix uniform identification numbers on spare parts and/or spare parts packages.

B. Consideration will be given to procurement by the reel of items such as rubber hose which can be cut appropriately in the field.

C. Packing of spare parts is to be one item per package so confusion of items does not occur.

D. Spare parts susceptible to rust shall be rust proof packed.

E. Items already in stock in large numbers and which are only very infrequently restocked will be eliminated from consideration.

F. Items which, although not already in stock in large numbers, are only infrequently restocked will be procured in small quantities.

G. Procurement schedule for parts for regular maintenance will be such that they are delivered when actually needed.

H. Items which cannot tolerate long periods of storage (rubber seals, etc.) will be procured in quantities that will be used up with the warranty period of

the manufacturer. Expiry date for use of these items will be clearly indicated upon delivery of the same.

I. Inexpensive items that can be readily procured locally will be eliminated from consideration.

J. At the time of spare parts delivery, the subject contractor will be required to inventory existing stocks on hand at NWSDB to ensure effective use of the items.

14) Support vehicles

The project offices are already in possession of a considerable amount of support vehicles in various statuses of present condition. Present deployment status of vehicles is summarized in Table 2-13.

TABLE 2-13 QUANTITIES AND STATUS OF PRESENTLY DEPLOYED VEHICLES

Office:	Rig			Pickup		Wagon		Cargo truck	
	To be newly procured	Under pervious Japanese Grant	From other donors	No problem	Poor condition	No problem	Poor condition	No problem	Poor condition
Anuradhapura	1	2	3	0	2	1	1	8	0
Kurunegala	1	2	1	2	0	1	1	7	0
Monaragala	1	0	1	1	3	0	1	3	1
Embilipitiya	1	1	--	1	2		1	3	0
Kalutara	0	3	2	0	2	0	1	7	0
Head office	1	--	--	2	0	5	3	4	2

Putting consideration of present vehicle operating condition aside, numbers of support vehicles on hand can be said to be generally sufficient given the number of existing rigs at each office. Accordingly, vehicles to be procured under the Project are targeted for use in support of the five new rigs to be supplied. Deployment of these vehicles would thus be the project offices at Anuradhapura, Kurunegala, Monaragala, Embilipitiya and the head office. Vehicles are to be of the double cab type generally used in Sri Lanka and capable of 750 kg loading weight. This equipment will be used for the transport of personnel and equipment.

As no new rigs will be deployed under the Project to the regional support centers, support vehicles as well will not be deployed thereat.

15) Cargo truck

The cargo truck is to be used to transport personnel and materiel (casing pipe, etc.) required in the course of well rehabilitation works, and were requested for deployment at the regional support centers. However, a large quantity of this equipment is already on hand at the centers, with Hambantota being the only location currently without a cargo truck. As Hambantota is an important area for future development of the 3 tier

system, impact of deployment of the cargo truck thereat would be large. Procurement of the same is accordingly considered appropriate under the Project.

This equipment is to be of the double cab type with loading capacity of 1,750 kg, in order to effectively carry both personnel and long, heavy objects.

Current vehicle deployment status at the regional support centers is as shown in Table 2-14.

TABLE 2-14 CURRENT VEHICLE DEPLOYMENT STATUS AT THE REGIONAL SUPPORT CENTERS

Center	*Pickup*	*Wagon*	*Van*	*Truck*	*Motor bike*	*Tractor*
Ampara	2	--	--	1	--	1
Bandarawela	2	1	--	2	--	1
Hambantota	--		--	--	--	1
Kalutara	2	1	--	2	--	1
Kandy	11	3	4	7	10	2
Kulunegala	2	--	1	2	--	--
Matara	10	3	2	6	4	4
Ratnalana	5	2	1	4	--	--

Source: NWSDB

16) Field water quality, and other test and survey equipment

At present, water quality testing activities are being carried out by the Investigation Section of the NWSDB central office. With expansion of the NWSDB well drilling rig fleet since 1977, it has become necessary to carry out water testing at over 1,000 locations annually. Conduct of water quality testing in the field enables a quick halt to unfruitful drilling works, and therefore cutting down on unproductive construction effort. The subject equipment is thus deemed suitable under the Project in this light, in addition to the concern over high fluorine content groundwater in certain parts of Sri Lanka. GPS well site locating equipment and hand auger to assist in ascertaining geological structure at the well site are also to be procured.

In addition, water level and EC gauging equipment to be used at the site during drilling operations will be procured.

These items would be in the following quantities.

A. Water quality testing equipment;

Total of 5 nos., comprising 1 no. each at the 5 project offices of Anuradhapura, Kurunegala, Monaragala, Embilipitiya and Kalutara,.

B. Hand auger:

5 units at the Investigation Section · Planning and Design Department, head office.

C. Water level indicator:

Total of 16 units, 1 each for each of the 11 existing rigs and 5 new rigs.

D. GPS:

Total of 6 units, comprising 1 unit each at the 5 project offices of Anuradhapura, Kurunegala, Monaragala, Embilipitiya and Kalutara, and 1 unit at the head office.

E. Conductivity meter:

Total of 16 units, 1 each for each of the 11 existing rigs and 5 new rigs.

17) Hand pump

Number of villages to which hand pumps are to be deployed under the Project total 800 as indicated below. This is equivalent to the number of wells scheduled for construction in FY 1997 under the Public Investment Plan. Hand pumps required in FY 1998 and subsequent thereto will be procured by NWSDB using its own resources.

Kalutara	48
Embilipitiya	8
Anuradhapura	108
Mahaweli	10
Puttalam	123
Monaragala	10
Kurunegala	455
Matara	18
Anamaduwa	20
Total	800

The VLOM (village level operation and maintenance) pump occupies an important position under the 3 tier program aimed at participation of beneficiaries in well operation and maintenance. Prerequisites for the VLOM are simple design and high reliability.

To date, NWSDB has promoted, with the encouragement of UNICEF, the utilization of the MK III (Indian make) pump in its efforts to extend the 3 tier system. Utilization of this type pump under this Project as well will have the additional merit of compatibility of spare parts with existing equipment.

In light of the above, the MK III pump is to be adopted under the Project.

Prospective manufacturers of the Indian MK III hand pump will be limited to those recommended by UNICEF to ensure quality (over 100 firms manufacture this item, and quality varies significantly depending on the maker).

The above equipment plan is summarized out in Table 2-15.

TABLE 2-15 EQUIPMENT PLAN

No.	Item	Basic technical features	Qty	Location of deployment	Justification
1-1	Light duty rig	w/ down the hole hammer (air hammer [DTH] for revolving drill rig), 100 m drilling with 6 in. casing	1	Head office	For sites with difficult access
1-2A	DTH · mud drilling rig	mud pump : 1,000 lit./min · 24 kg/cm², w/ DTH compressor; 100 m drilling with 10 in. casing	2	Anuradhapura, Embilipitiya	For use in sites in dry zone where well depth is relative deep. To be used with large capacity mud pump.
1-2B	DTH · mud drilling rig	mud pump : 750 lit./min · 24 kg/cm², w/ DTH compressor; 100 m drilling with 10 in. casing	2	Kurunegala, Monaragala	For use with medium capacity mud pump for well drilling to the conventional 50 m depth. (to be able to access sites easily and also be capable of drilling to 100 m depth.
1-3	Clay cutter, clamp, shackle	for use with DTH · mud drilling rig	6	1 unit to be deployed with each new rig, and 2 units reserve at head office	For use in mud drilling operations. 2 units in reserve as NWSDB is as yet unfamiliar with this type of drilling.
1-4	Tricone bits	for use with DTH · mud drilling rig; 6 different dia.	8 sets each	2 units to be deployed with each new rig	For use in mud drilling operations. 2 year supply to be provided.
1-5	Spare parts	for light duty and DTH · mud drilling rig,	1 set	To be managed primarily by head office	2 year supply to be procured in principal. Item priority determined by urgency of part.
2-1	Air compressor	17 m³/min, 12 bar	4	2 units at Kurunegala; 2 units at Kalutara	To replace obsolete equipment. Intended for use with existing rigs.
2-2	High pressuring washing machine	w/ air compressor	5	At each project office	For rig cleaning as part of rig O&M.
2-3	Repair equipment	20 t jack, 5 t chain block	5 sets	At each project office	For disassembly, assembly of heavy rig parts.

No.	Item	Basic technical features	Qty	Location of deployment	Justification
2-4	Drill hammer	for use with DTH	1 set	At each project office	For use with existing rigs. Quantities determined on basis of scheduled well construction in each area.
2-5	Bits	for use with DTH	2 set	At each project office	For use with existing rigs. Quantities determined on basis of scheduled well construction in each area.
2-7	Well flushing equipment	5 m³/min; w/ 7 bar compressor, 4-1/2 in. dia.; 50 m depth	3	Matara, Kurunegala, Anuradhapura	For well flushing under the 3 tier system for well O&M.
2-8	Spare parts for existing rigs and support vehicles	for 11 units of rig, 7 units of compressor, 3 units rig carrier	1 set	To be managed primarily by head office	2 year supply to be procured in principal. Item priority determined by urgency of part.
3-1	Pickup	4 WD, double cabin, 750 kg load capacity	5	1 unit to be deployed with each new rig.	Work vehicle for new rigs.
3-2	Cargo truck	double cabin, 1,750 kg load capacity	1	Hambantota	For assignment to support center which at present has no such vehicle. For use under the 3 tier O&M system.
4-1	Water quality field testing equipment	Ec, Ph, Eh, Na^{+}, K^{+}, Ca^{++}, Mg^{++}, Fe^{++}, HCO_3^{-}, CO_3^{--}, SO_4^{--}, Cl^{-}, NO_3^{-}, F^{-}	5 sets	At each project office	For quick response measuring of fluorine content in groundwater in the field.
4-2	Water level indicator	50 m	16	For each of the 16 rigs procured under Japanese assistance	Simple water level meter for insitu measuring of water levels.
4-3	Hand auger	10 m	5	Head office	For sampling at time of well drilling.
4-8	GPS	5 channels	6	At each project office, and main office	For accurate well location plotting.
4-10	Conductivity meter	10 micro mho/cm ~ 10,000 mho/cm	16	For each of the 16 rigs procured under Japanese assistance	For quick response check of water quality. Where water quality it poor, well excavation can be immediately suspended, minimizing wasted drill time.
5-1	Hand pump	35 m, Indian MK III	800	To be deployed from head office to project offices as needed	Sufficient quantity to equip wells to be constructed in 1997 with rigs procured under Japanese assistance.

As discussed earlier, a portion of items are to be procured locally, as quality is sufficient and an adequate after sales service structure is in place. A breakdown of off-shore / local procurement is given in Table 2-16.

TABLE 2-16 BREAKDOWN OF OFF-SHORE LOCAL PROCUREMENT

No.	*Item*	*Technical features*	*Procured in Japan*	*Locally procured*
1-1	Light duty rig	w/ DTH hammer and compressor	○	
1-2A	DTH · mud drill rig (A)	mud pump (A), w/ compressor for DTH	○	
1-2B	DTH · mud drill rig (B)	mud pump (B), w/ compressor for DTH	○	
1-3	Clay cutter, other rig accessories	clay cutter, clamp, shackle	○	○
1-4	Tricone bit	tricone bits, bit-subs, bit breakers for 1~2 rigs	○	○
1-5	Spare parts	for light duty rig, DTH · mud drill rig	○	
2-1	Air compressor	for existing rigs	○	○
2-2	High pressure washing machine	for rig O&M	○	○
2-3	Jack, etc. repair equipment	20 ton	○	○
2-4	Drill hammer	for DHT hammer	○	○
2-5	Button bit	for DHT hammer	○	○
2-6	Well flushing equipment	w/ air compressor	○	
2-7	Spare parts for existing rigs	parts for 11 units of existing rig, and 8 compressors	○	
3-1	Support vehicle	double cab, 750 kg load weight	○	
3-2	Cargo truck	double cab, 1,750 kg load weight	○	
4-1	Water quality field test equipment	EC, pH, nitrium, calium testing, flourine detection	○	
5-1	Hand pump	35 m Indian make MK III		○

Table 2-17 District-wise well drilling performance by NWSDB

District	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	TOTAL
Ampara	0	0	6	6	114	88	146	0	8	21	2	15	8	18	8	21	6	467
Anuradhapura	1	106	0	61	301	368	336	130	441	271	96	50	102	106	243	222	130	2,964
Badulla	0	0	0	0	0	2	37	56	46	63	121	9	39	15	26	23	46	483
Batticaloa	0	0	0	0	0	0	1	5	0	0	0	0	0	0	0	0	0	6
Colombo	0	0	1	0	0	0	0	6	25	0	0	0	6	8	11	4	13	74
Galle	0	0	0	0	0	0	13	3	19	5	0	0	8	24	16	32	5	125
Gampaha	0	0	0	0	5	0	13	26	24	10	6	13	7	8	39	116	53	320
Hambantota	85	23	0	3	0	2	100	100	120	6	0	2	3	16	10	10	3	483
Kalutara	0	0	0	0	0	0	161	121	168	158	116	38	45	26	47	33	15	928
Kandy	0	0	0	0	0	0	12	1	74	26	51	42	27	49	45	7	2	336
Kegalle	0	0	0	0	0	0	0	3	15	11	9	9	3	30	3	5	4	92
Kurunegala	0	5	7	0	107	22	124	137	227	126	59	24	28	49	33	18	46	1,012
Mannar	0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24
Matara	0	0	0	62	1	0	13	103	4	4	0	2	1	3	25	28	2	248
Monaragala	0	0	0	0	0	0	1	18	23	17	0	28	110	8	7	8	44	264
Nuwaraeliya	4	1	221	134	0	0	52	104	199	42	3	5	38	136	8	1	9	957
Polonnaruwa	0	0	0	0	0	0	3	0	7	0	0	0	2	9	10	2	6	39
Puttalam	0	0	0	0	0	2	80	177	0	0	0	7	4	20	19	6	29	344
Ratnapura	0	60	0	0	0	0	0	5	86	119	1	4	2	61	73	70	55	536
Trincomalee	0	0	0	0	0	161	347	92	42	92	47	20	2	15	12	6	0	836
Vavuniya	0	0	0	0	0	17	0	44	0	21	0	6	6	40	0	25	0	159
TOTAL	90	219	235	266	528	662	1,439	1,131	1,528	992	511	274	441	641	635	637	468	10,697

CHAPTER 3 IMPLEMENTATION PLAN

3-1 Implementation Plan

3-1-1 Implementation Concept

Implementation of the Project will entail, within the designated period, detailed design of equipment, tender related procedures, equipment procurement, transport of the same to the executing agencies head office and handing over thereat. An implementation plan has been proposed and recommendations formulated to completion of the Project as scheduled. These take into consideration location of procurement, quantities and required implementation period.

None of the equipment to be procured under the Project requires installation. The bulk of the equipment to be supplied is destined for deployment at the 5 project offices of the Ground Water Section · NWSDB at Anuradhapura, Kurunegala, Monaragala, Embilipitiya and Kalutara. In this regard, the Ground Water Section will assume responsibility, either at its head office or its store house at Ratmalana near Colombo, for customs procedures, equipment inspection and confirmation, handing over procedures and deployment of items to destination offices.

Accordingly, the consultant for the Project will provide an overall management structure for the Project, to entail spot checks by consultant supervisory staff when needed in the course of Project implementation to ensure that works are on track.

3-1-2 Implementation Conditions

Although many of the items to be supplied are relatively large and readily recognizable such as rigs, compressors, etc., their destinations of deployment are varied, and to prevent confusion in deployment of accompanying accessories, etc., items procured in Japan will be packed for easy identification and grouping into lots at the local equipment collection point for delivery to the designated office.

In the case of self propelled equipment and vehicles, relevant manuals, tools, and small accessories such as cigarette lighter, etc. will be packed separately to avoid confusion or disappearance of such items enroute.

Final check of equipment items will be done either at the Ground Water Sections store facility at Talawala, or another suitably designated store house location, in the presence of persons-in-charge from the contractor, consultant and executing agency. Also, to facilitate the most timely deployment of equipment to designated destinations, the consultant will provide support to the executing agency where necessary in the expediting of customs procedures, vehicle registration, and other administrative tasks. However, in light of security concerns, the consultant will not undertake equipment check at Colombo port.

3-1-3 Consultant Supervision

Due to the fact items are numerous, spare parts are included and destination of ultimate equipment deployment are numerous, implementation supervision will be necessary in the form of advice and guidance in pre-shipping inspection of equipment, equipment inspection and check upon arrival in-country, handing over procedure, and packing of items by lot for delivery to the relevant offices of deployment. In this regard, the consultant will assign to its team personnel with thorough knowledge of local situation and conditions in Sri Lanka, and will dispatch personnel to the field on a spot basis at critical junctures of the implementation plan.

Implementation supervision tasks under the Project are mainly the following:

① Discussions with executing agency on and preparation of detailed specifications for equipment items

② Preparation of tender documents, and assistance with tendering procedures

③ Assistance in tender evaluation

④ Pre-shipping inspection of equipment procured in Japan

⑤ Visual confirmation of equipment condition and package quantities upon arrival in Colombo (to be done by the executing agency)

⑥ Inspection of procured equipment at the Ground Water Section's storage facility and supervision of handing over procedures

Individual responsibilities of each member of the consultant team with regards to the above supervisory works are as follows:

Team leader:

① Overall supervision of the consulting team's responsibilities

② Close liaison and discussion with the executing agency on key maters during implementation

③ Supervision of discussions between the consultant and the executing agency with regards to detailed design of equipment

④ Confirmation of arrival in Sri Lanka of equipment procured in Japan

⑤ Preparation of a draft proposal for spare parts management system

Equipment engineer:

① Participate in discussions between the consultant and the executing agency with regards to detailed design of equipment

② Pre-shipping inspection of equipment procured in Japan

③ Confirmation of arrival in Sri Lanka of equipment procured in Japan

Tender document specialist

① Preparation of tender documents and assistance in tendering procedures

② Liaison with JICA on key matters in the course of the Project

3-1-4 Procurement Plan

Equipment to be procured is specialized equipment for groundwater development, and given the experience to date in use of such equipment by the executing agency, as well as the need to ensure sustainable utilization of the same, it is essential that selected manufactures have qualified agents established in Sri Lanka for after sales service of equipment where necessary.

In this light, equipment is to be procured in Japan, locally in Sri Lanka or from a supplier in a third country with agent support in Sri Lanka. Possible countries of original manufacture of equipment are indicated in Table 3-1.

TABLE 3-1 POSSIBLE COUNTRIES OF ORIGINAL MANUFACTURE OF EQUIPMENT ITEMS

	Item	*Coutry of manufacture*
1-2A	Compressor for DTH · mud drilling rig	Belgium, US, UK
1-2B	Compressor for DTH · mud drilling rig	Belgium, US, UK
1-3	Clay cutter and other rig accessories	Belgium, US, UK
1-4	Tricone bits	Belgium, US, UK, India
2-1	Air compressor	Belgium, US
2-2	High pressure washing machine	US, UK
2-3	Jack and other repair equipment	US, UK, India
2-4	Drill hammers	US, UK, India, Sweden
2-5	Button bits	US, UK, India
5-1	Hand pumps	India

3-1-5 Implementation Schedule

The Project will officially commence with the Exchange of Notes (E/N) for Grant Aid cooperation between the governments of Sri Lanka and Japan.

Upon signing of the said E/N, the Sri Lankan government will move promptly to enter into contract with a Japanese consultant for detailed design and implementation supervision works under the Project. Following signing of this contract, the consultant will carry out detailed design, tender document preparation, and assist the Sri Lankan government with tender procedures and evaluation, contract negotiation and contract signing with the selected contractors. Detailed design works by the consultant will require 4.0 months.

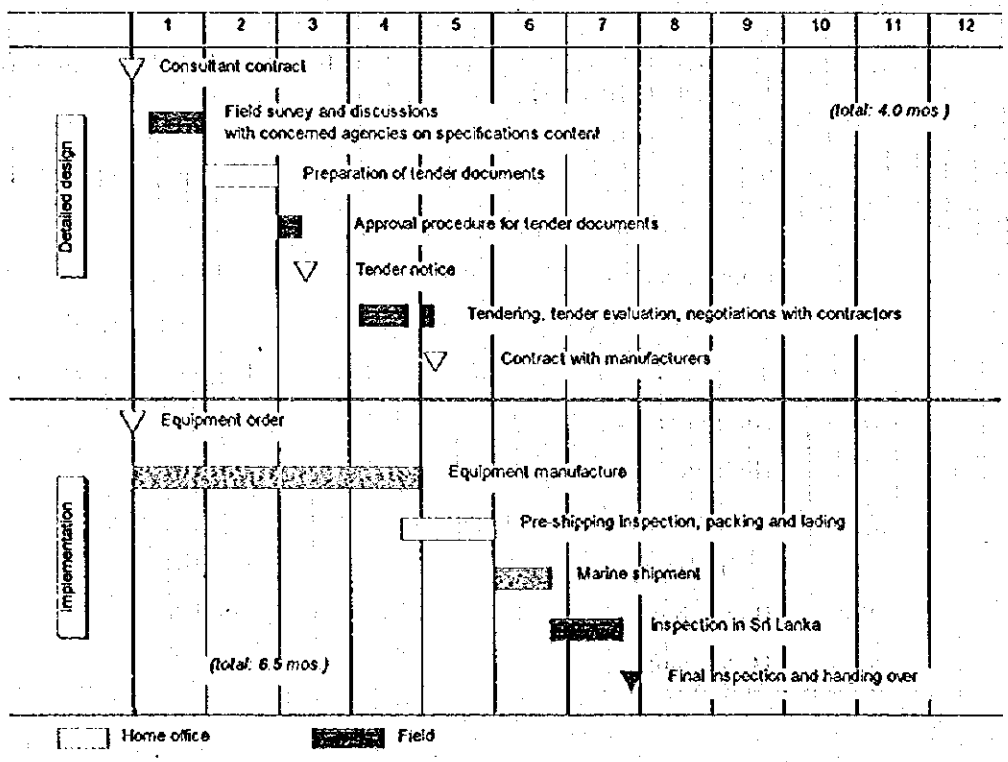
Following contract between the contractor and the Sri Lankan government, the former will be required to immediately begin procurement works after verification of the contract by the Japanese government. In light of the type of equipment requested, it is estimated that 4.0 months will be necessary for manufacture. Packing and lading in Japan will require another 3 weeks, followed by 3 weeks for marine shipment to Colombo.

Upon confirmed arrival of the consignment at Colombo port, the consultant team will enter Sri Lanka to monitor progress of customs procedures, inspect equipment after arrival at Ground Water Section · NWSDB's storage facility, and supervise handing over procedures. The foregoing are anticipated to require 1 month.

On the basis of the above, the detailed design of the Project is estimated to require 4.0 months 6.5 months required for overall implementation.

Implementation schedule for the Project is diagrammed in Figure 3-1.

FIGURE 3-1 IMPLEMENTATION SCHEDULE



3-1-6 Obligation of Recipient Country

Necessary measures to be taken by the Government of Sri Lanka on condition that Japan's Grant Aid is extended are as follows:

(1) To bear commissions to the Japanese foreign exchange bank to execute the banking services based upon the banking arrangement. (A/P commission and payment commission)

(2) To ensure prompt unloading, customs clearance at port of disembarkation in Sri Lanka and payment of relevant duties for equipment from off shore.

(3) To make budgetary arrangements to secure technical personnel to operate rigs, and to achieve well construction targets

(4) To accord Japanese Nationals, whose services may be required in connection with the supply of the products and services under the verified contracts, such facilities as may be necessary for their entry into Sri Lanka and stay therein for the performance of their work

(5) To use effectively all the equipment purchased under the Grant

(6) To manage and maintain the procured equipment properly, and make regular reports to the Japanese government in this regard

(7) To bear all the expenses other than those to be borne by the Grant, necessary for the execution of the Project

(8) To make budgetary arrangement and secure all personnel necessary for the execution of the Project

(9) To establish a sustainable O&M structure by the executing agency for equipment under the Project

(10) To provide data and information necessary for the Project

As existing facilities and structures are to be used for storage and deployment of equipment, the establishment of new facilities and structures will not be necessary under the Project. However, a mechanism for recuperating depreciation cost for equipment and spare parts (by incorporating the same into well construction cost, etc.) will be an essential element in establishing NWSDB fiscal independence in well construction activities in the future.

3-2 Project Cost Estimation

In order to execute this project under the Japan's Grant Aid, the government of Sri Lanka needs to shoulder the amount of Rs. 11,512,000 (equivalent to ¥23,000,000) per annum. The breakdown of such cost is shown below:

a) labor cost related to introducing new rigs	Rs. 6,552,000 p.a.
b) direct cost related to introducing new rigs	Rs. 4,960,000 p.a.
TOTAL:	Rs. 11,512,000 p.a.

3-3 Operation and Maintenance Costs

Operation and maintenance plan for the equipment to be procured under the Project is described below.

(1) O&M of Existing Rigs (11 units)

Existing spare parts on hand and that to be procured under the Project will be sufficient for rig operation over the 4 year period to the year 2000. With spare parts procurement, required nos. of wells drilled per year for each existing rig until the target year will be 64 nos. In order to support this level of performance, it will be necessary to (i) establish a regular rig maintenance program including regular equipment check up, (ii) establish a structure for rapid response to repair needs in case of rig accident or breakdown, (iii) formulate an effective and efficient well drilling program, etc. In addition, an appropriate management system for spare parts must be put in place.

The executing agency presently carries out a range of activities related to the well construction and well O&M targeted under the Project. These include survey of promising well sites by physical prospecting engineers at the project offices, , deployment of well drilling teams (drilling engineers, laborers, air compressor operators, dispatch of support vehicles · trucks and drivers required for well works, etc.). Mechanical engineers for regular maintenance of equipment are also in the field. This structure will be applicable to the equipment under the Project as well, and technical level of the same is considered sufficient for the purposes of the Project. Although some problem points in the present management system for spare parts have been discussed earlier in this report, this can be adequately addressed by the recommendations contained herein and on this basis it is expected that an even more effective parts management system will be operative in the future.

It is necessary that the head office formulate a comprehensive well construction plan for effective works in the future. It is also imperative that a centralized management plan for spare parts be established to respond quickly to the needs at the project offices. This system must be capable of accurate inventory of stocks, and appropriate and timely deployment of parts required for regular maintenance, and use of parts with minimal storage tolerance within the designated utility life of the same. It is proposed that a computerized system be adopted to achieve this.

Also, it is necessary that the head office be able to respond promptly to requests from the project offices for equipment overhaul and repair. As almost all major repairs are carried out at the head office's repair shop, management of this facility must be such that it can address within an appropriate time frame the project office needs for equipment repair.

(2) O&M of New Rigs (5 units)

Of the 5 nos. of new rigs to be procured under the Project, 4 nos. are to be deployed to the project offices. Arrangements for personnel and budget to operate these rigs have already been made by the executing agency. Training of personnel in mud drilling operations, heretofore an unfamiliar type of drilling for the executing agency, is now in progress. It will be necessary in the future to fully utilize this training experience, and where necessary to seek the advice and assistance of the rig supplier's agent and the Water Resources Bureau (which has experience with mud drilling) when unfamiliar problems arise in the course of the well construction works.

In the case of DTH drilling including the light duty rig, the executing agency has over 10 years of experience with this kind of work, and the recommendations in this regard are the same as for the existing rigs.

A quantity of spare parts sufficient for 2 years operation will be supplied with the new rigs. However, an O&M program to sustain rig operation after utilization of the spare parts to be procured under this Project must be formulated in light of the 7 year economical life and 15 year utility life of the rigs. In order to establish a system whereby the executing agency can maintain sustainable O&M under its own resources, it is necessary to enact measures to secure a pool of funds for spare parts procurement through incorporation of the depreciation cost of equipment in the well construction cost, making arrangements for such funding from the national budget, etc.

Criteria for establishment of a viable O&M system for the well flushing equipment are the same as discussed above for the new rig equipment.

(3) O&M of Vehicles

The principal issue with regards to vehicles is the possibility of use outside their intended purpose under the Project. Five nos. of pickup for support of new rig drilling works, and 1 no. of cargo truck for well O&M are to be procured, and these should be deployed in such a way as to avoid redundancy with equipment already on hand in this regard for existing rigs. Bearing in mind the foregoing, it is expected that the executing agency strive to properly utilize the vehicles procured.

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATIONS

4-1 Project Effect

Impacts to be expected as a result of implementation of the Project are as follows.

NWSDB has targeted creation of a safe and stable supply of potable water for every citizen in the country by the year 2000.

In order to achieve the foregoing objective, NWSDB has formulated a well construction plan from 1994 to the year 2000 which calls for the construction of 7,500 new deep wells. However, the majority of rigs in the possession of NWSDB are over 10 years old, and as of February 1996 only 8 nos. of the rigs procured with assistance from Japan are in operation. Furthermore, wear and tear on rigs supplied with cooperation from other donors is significant, with only 4~5 nos. operable. NWSDB had planned to carry out rig repair with its own resources and thereby render operable in 1996 eleven of the Japanese rigs and 8 nos. of the other donor assisted rigs. Although this will improve well drilling production per year, such a situation will still only allow for construction of 5,000 wells by the year 2000.

Under the Project, new rigs and spare parts for existing rigs will be procured. Spare parts for existing rigs will upgrade the drilling efficiency of the same, and the addition of new rigs will augment well construction capacity. The combination of these improvements in NWSDB's drill rig fleet is expected to make possible the excavation of the targeted 7,500 deep wells by the year 2000.

Specifically, the equipment to be procured under the Project will enable the construction of 2,500 wells by the year 2000. An average of 150 persons are expected to benefit from each hand pump equipped well constructed. Accordingly, a total population of 375,000 persons would benefit with safe and stable potable water supply from the said 2,500 wells. Furthermore, this benefit will be concentrated in rural areas of poor access which heretofore have not had access to water supply facilities.

Impact and nature of the Project can be summarized as follows:

① Project beneficiaries will be the average rural resident, totaling 375,000 persons

② The project is targeted at the most basic of human needs (BHN), i.e. safe and stable potable water supply. Establishment of safe and stable potable water supply will directly serve to prevent the spread of water borne diseases, and relieve the rural population (primarily woman) of the harsh task of traveling long distances on foot and retrieve by hand water for domestic purposes.

③ Sustained and effective use of equipment to be procured under the Project is anticipated in light of the fact that NWSDB has over 10 years experience in

operation rigs for well construction, and the said equipment is well within the independent technical level and available personnel capability of the executing agency to be appropriately operated and maintained to achieve the Project objectives.

④ The equipment to be procured will significantly contribute to achieving the national objective of safe and stable potable water supply for every citizen of the country by the year 2000.

⑤ The equipment to be procured is targeted at the rural water supply development sector, and although water tariffs sufficient to cover hand pump O&M are to be collected from the beneficiaries, well construction costs themselves are to be borne under the national budget and as such the Project is not intended as a profit making one.

⑥ Draughting of ground water is to be by hand pump, on a scale which will have no impact on the natural environment.

In light of the above impacts and nature of the Project, it is considered well compatible with criteria for eligibility under Japanese Grant Aid, and is concluded to be an extremely effective Project for such assistance.

4-2 Recommendation

As discussed above, a considerable beneficial impact is anticipated under the Project, and the Project is well suited for Japanese Grant Aid given its theme of upgrading basic human needs for a large beneficiary population. Furthermore, the executing agency has past experience with similar type projects, and solid personnel, funding and technical capabilities to achieve the objectives of the equipment procurement under the Project.

However, addressing the issues below will make possible smoother and more effective implementation of the Project.

① At present, the bulk of rig overhaul and repair is being done at the head office's repair shop. Although some repairs are done at the Kandy Regional Support Center under NWSDB's Operations division, such instances are few. Also, due to the fact that the Operations division and Development division offices are separate, the operation and maintenance system for hand pumps is not integrated, and redundancy of equipment occurs. It is estimated that redundancy of O&M costs also occurs.

In the future, integrated operations between the project offices and support centers will be essential in achieving the target well construction of 2,500 nos., and it is considered that likewise integration of the two divisional offices within NWSDB will result in more effective operations.

② Stocking and allocation of spare parts by log book has been in operation for

over 10 years. This has resulted in the accumulation of a vast amount of data; however, locating and assessing inventories for specific items is difficult due to the fact that the said data is in log book form.

It is therefore recommended that a new computerized store management system be introduced to upgrade efficiency of spare parts management.

③ The request for spare parts under the Project is the second such request following upon that under the Potable Water Supply Project, 1986. Field survey by the Study Team indicated that the executing agency is currently carrying out rig maintenance under its own resources including a portion of necessary spare parts procurement. However, quantities of such spare parts procurement are few, and are not sufficient to upgrade rig performance hence the request for spare parts under this Project.

It is judged that the spare parts to be procured under the Project will be sufficient to operate and maintain the existing 11 units of rigs for the four year period until the year 2000. After that, the subject equipment will have exceeded its utility life and will be assumed to be inoperable. On the other hand, the new rigs will continue to be operable for around 15 years, and it is necessary to formulate a plan for sustainable O&M of this equipment. Furthermore, it will be required to formulate measures to compensate for the existing rigs which will not be usable after 4 years.

In this regard, it is recommended that a strategy be formulated by the executing agency to enable it independently sustain the operation and maintenance of its well drilling capability, to include a budgetary framework for future rig and spare parts procurement through such measures as incorporating depreciation cost of equipment in well construction cost, etc. Specifically, for the maintenance of the 5 new rigs to be procured under the Project, an annual outlay of Rs 6 million or establishing a per well drilling fee of Rs 95,000 will be necessary. (Criteria for the foregoing figures are given in Annex *****.)

④ Promotion of the 3 tier system including participation by beneficiaries in well operation and maintenance is highly commendable. The major issue in this regard is to limit selected hand pump types to those of sufficiently simple design to be effectively maintained at the village level (VLOM). At present, a number of pumps, including the Indian MK III, are being procured by NWSDB; however, a set policy as to pump type is not in place. It is thus recommended that NWSDB promptly take steps to designate recommended pump types and manufactures, with emphasis on simplicity of design, to further foster effective pump operation and maintenance at the village level.

APPENDICES

Table of Contents

Appendix 1

Member List of the Survey Team

1	Mr. Y. Nakamura	Leader	Director, JICA Sri Lanka Office, JICA
2	Mr. S. Masuda	Coordinator	First Basic Design Study Division, Grant Aid Study & Design Department, JICA
3	Mr. M. Suda	Chief Consultant / Operation and Maintenance Planner	Chuo Kaihatsu Corporation
4	Mr. S. Matsuhashi	Hydrogeologist	Chuo Kaihatsu Corporation
5	Mr. K. Fujita	Equipment Planner	Chuo Kaihatsu Corporation

Appendix 2

Survey Schedule

Date		Leader ; Mr. Y. Nakamura Coordinator ; S. Masuda	Chief Consultant / Operation and Maintenance Planner ; Mr. M. Suda	Hydrogeologist ; Mr. S. Matsuhashi	Equipment Planner ; Mr. K. Fujita
1	Jan. 7 (Sun)		SQ997-SQ442(Narita-Singapore-Colombo)		
2	Jan. 8 (Mon)		Embassy of Japan, JICA Office in Sri Lanka, Ministry of Housing, Construction and Public Utilities, External Resources Department(ERD), National Water Supply and Drainage Board(NWSDB)		
3	Jan. 9 (Tue)		NWSDB, UNICEF, National Planning Department		
4	Jan. 10 (Wed)		NWSDB	Move to Anuradhapura	
5	Jan. 11 (Thu)		Discussion with NWSDB, Survey of Private Drilling Companys(3)	Geological and site survey and water quality test in Anuradhapura	Equipment and spareparts check at Anuradhapura
6	Jan. 12 (Fri)		Discussion with NWSDB, ADB Project Office, Check spareparts store	Geological and site survey and water quality test in Anuradhapura	Equipment and spareparts check at Anuradhapura
7	Jan. 13 (Sat)		Visiting to Kurunegala Project Office, Check Existing Rids(2) and Spareparts store	Move to Kandy, Geological and site survey and water quality test in Kandy	Move to Kandy, Equipment and spareparts check at RSC South
8	Jan. 14 (Sun)		Visiting to WHO Project in Eluwapitiya, Visiting to Kalutara Project Office, Check Existing Rig(1) and Spareparts store	Geological and site survey and water quality test in Mahiyangana, Move to Moneragara	Equipment and spareparts check at Mahiyangana, Move to Moneragara
9	Jan. 15 (Mon)		Analyzing Data	Geological and site survey and water quality test in Moneragara, Move to Embilipitiya	Equipment and spareparts check at Moneragara, Move to Embilipitiya
10	Jan. 16 (Tue)		Embassy of Japan, Data Collection at NWSDB, Discussion with DTZ	Geological and site survey and water quality test in Embilipitiya, Move to Matara	Equipment and spareparts check at Embilipitiya, Move to Matara
11	Jan. 17 (Wed)		Data Collection at National Planning Department, Visiting to Ceylon Supply(Ltd.) Local Equipment	Geological and site survey and water quality test in Matara	Equipment and spareparts check at Matara
12	Jan. 18 (Thu)		Ministry of Finance, Planning, Ethnic Affairs and National Integration, Discussion with IDA, Discussion with WRD	Geological and site survey and water quality test in Hambantota	Equipment and spareparts check at Hambantota

Date		Leader ; Mr. Y. Nakamura Coordinator ; S. Masuda	Chief Consultant / Operation and Maintenance Planner ; Mr. M. Suda	Hydrogeologist ; Mr. S. Matsuhashi	Equipment Planner ; Mr. K. Fujita
13	Jan. 19 (Fri)	SQ997-SQ442 (Narita-Singapore-Colombo)	Discussion with NWSDB, Lunch with the Secretary of MHC&P, Data Collection at WRD	Lunch with the Secretary of MHC&P, Data Collection at WRD	Lunch with the Secretary of MHC&P, Check Spareparts at NWSDB store
14	Jan. 20 (Sat)	Visiting to Kurunegala Project Office, Visit Drilling sites (2) and GTZ well site		Analyzing Data	Check Spareparts at NWSDB store
15	Jan. 21 (Sun)	Visiting to Kandy Community Water Supply & Sanitation Programme(CWSSP)		Analyzing Data	Check Spareparts at NWSDB store
16	Jan. 22 (Mon)	Discussion with World Bank, NWSDB and Acting Secretary of MHC&P, Meeting With JICA	Discussion with World Bank, NWSDB and Acting Secretary of MHC&P	Data Collection at NWSDB	Check Spareparts at NWSDB store
17	Jan. 23 (Tue)	Discussion with World Bank and External Resources Department, Discussion with NWSDB for Minute of Discussions(M/D)		Geological and site survey and water quality test in Kurunegala and Puttalam	Equipment check at Kalutara Project Office
18	Jan. 24 (Wed)	Meeting with JICA, Discussion with NWSDB for M/D, Visit to Spareparts store and Workshop, Visit to Ambassador residence	Discussion with NWSDB for M/D, Visit to Spareparts store and Workshop, Visit to Ambassador residence	Discussion with NWSDB for M/D, Visit to Workshop, Visit to Ambassador residence	Discussion with NWSDB for M/D, Invitation Distribution to ERD and MHC&P, Visit to Ambassador residence
19	Jan. 25 (Thu)	Team Meeting for M/D at JICA, Minute of Discussion Signing with Lunch at Hilton Hotel			
20	Jan. 26 (Fri)	Reporting to Embassy of Japan and JICA Sri Lanka Office	Discussion with NWSDB and Data Collection	Analyzing Data	Discussion with NWSDB and Data Collection
21	Jan. 27 (Sat)	EK076 (Colombo-Singapore)	Analyzing Data	Analyzing Data	Discussion with NWSDB and Data Collection, Check Spareparts at NWSDB store
22	Jan. 28 (Sun)		Analyzing Data	Analyzing Data	Analyzing Data
23	Jan. 29 (Mon)		Discussion with NWSDB, Data Collection at NWSDB and Ministry of Finance, Reporting to Embassy of Japan	Discussion with NWSDB and Data Collection, Reporting to Embassy of Japan	Discussion with NWSDB and Data Collection
24	Jan. 30 (Tue)		Discussion with NWSDB and Data Collection, Reporting to JICA Sri Lanka		
25	Jan. 31 (Wed)		UL302 (Colombo-Singapore)		
26	Feb. 1 (Thu)		JL712 (Singapore-Narita)		

Appendix 3

List of Party Concerned in the Recipient Country

Organization	*Name*	*Position*
Ministry of housing, Construction and Public utilities	Mr. K.A.S. Gunasekera	Secretary
	Mr. C.H. De tissera	Acting Secretary
	Mr. Lionel D. Wijendra	Director for Policy and Planning
	Mr. M.A.M.S.L. Attanayake	Deputy Director (Technical), Cws&Sp
National water supply And dranage board	Mr. T.B. Madugalle	Chairman
	Mr. M. Wickramage	General Manager
	Mr. P.M.R. Pathiraja	Additional General Manager (development)
	Mr. W. Weerarathne	Additional General Manager (operation)
	Mr. K.L.L. Premanath	Deputy General Manager
	Mr. H. Pinidiya	Deputy General Manager, ADB Office
	Mr. K.N.M.S. Fernando	Deputy General Manager, IDA PROJECT
	Mr. A.H.C. Silva	Deputy general Manager, RSC southern
	Mr. H.D.R.A. Pathirana	Assistant General Manager (Ground Water)
	Mr. D.S.D. Jayasiriwardene	Assistant General Manager (RWS)
	Mr. K.R. Dewasurendra	Assistant General Manager (P&D)/Manager (GW)
	Mr. M. Abeysekara	Manager (Ground Water Maintenance)
	Mr. A. Kodippli	Manager (GW 1)
	Mr. Aska peren	Manager (GW 5)
	Mr. T.W.S. Perera	Manager (P&C), RSC Sourhtern
	Mr. K.M. Premathilake	Project Officer, Moneragara
	Mr. A.I.K. Adilari	Project Officer, Anuradhapura
	Mr. N.I. Widarernasinghe	Sociologist, Regional Office, Anuradhapura
	Mr. K. Dharmapala	Asst, Engineer, Regional Office, Anuradhapura
	Mr. U.G.M. Ariyaratne	Project Officer, Kurunegala
	Mr. J. Samarakkody	Project Officer, Kalutara
	Mr. L.L. Aleivis	Maneger (o&m), rsc Central
	Mr. B.D.H. Jayaratne	Ground Water Engineer, rsc central
	Mr. K.G. Dayaratne	Chief Engineer (Monitaring), rsc central
	Mr. R.A.B. Samarakoon	Chief Engineer (const.), Rsc central
	Ms. Pradeeda Fernando	Chief Engineer for Performance and Management
	Mr. A. Jayasinghe	Chief Engineer for Cooperation Planning
Department of External Resources	Ms. D.D.J. Kudaligama	Assistant Director General
Department of national Planning	Ms. Malika Karunaratne	
	Mr. P. Sunanapala	Deputy Director
	Mr. Hiroyuki Ogiwara	JICA Expert
Ministry of Finance, Planning, Ethnic Affairs and National Integration	Mr. Chandrasena Maliyadde	Additional Secretary
	Mr. Jagatothoma	Assistant General Manager
Water Resouces Board	Mr. Y. Yoganathan	Chairman
	Mr. Newjon Karvnaratne	General Manager Hydrogeology
	Mr. Ananda Hapugaskumbura	Assistant General Manager Hydrogeology
Unicef	Mr. N. Weerasinghe	
WHO	Mr. Ngwe San	Sanitary Engineer
GTZ	Mr. Manfred Behnsen	Project Manager
World bank	Mr. Wiebe Moes	Sr. Sanitary Engineer, from Washington Enwrgy, Infrastructure & Environment Operation
	Dr. Sumith Pilapitiya	

Appendix 4

MINUTE OF DISCUSSIONS
ON
BASIC DESIGN STUDY
ON
THE PROJECT FOR IMPROVEMENT OF DRINKING WATER
IN
THE DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA

In response to a request from the Government of Sri Lanka (GOS), the Government of Japan decided to conduct a Basic Design Study on the Project for Improvement of Drinking Water in the Democratic Socialist Republic of Sri Lanka (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Sri Lanka a study team, which is headed by Mr. Yoshikatsu NAKAMURA, Director, JICA Sri Lanka office, and is scheduled to stay in the country from 7 January to 31 January, 1996.

The Team held discussions with the officials concerned of the GOS. In the course of discussions and field survey, both sides have confirmed the contents of the Project giving due consideration to the necessity of the ground water development for drinking water supply improvements in the rural areas, and operational performance of the ground water activities of the National Water Supply and Drainage Board. Main items of the Project are described in the attached sheets.

The team will proceed to further works and prepare the Basic Design Study Report.

Colombo, 25 January, 1996

Mr. Yoshikatsu NAKAMURA
Leader
Basic Design Study Team
JICA

Mr. C. H. De Tissera
Acting Secretary
Ministry of Housing,
Construction and Public Utilities

Mr. T. B. Madugalle
Chairman
The National Water Supply
and Drainage Board

1. Objective

The objective of the project is to provide potable water in rural communities by provision of necessary equipment.

2. Project Sites

The project sites are in the following 7 provinces.

Province
North Central Province
North Western Province
Central Province
Western Province
Province of Sabaragamuwa
Province of Uva
Southern Province

3. Executing Agency of the Government of Sri Lanka

The National Water Supply and Drainage Board (NWSDB) under Ministry of Housing, Construction and Public Utilities is responsible for the administration and execution of the Project.

4. Scope of Cooperation

As a result of discussions with the Team, the items described in **Annex I** were finally requested by the Government of Sri Lanka.

However, final components of the Project and quantities and specifications of equipment to be provided will be determined after further consideration in Japan.

5. Project Name

The name of the Project is changed as follows;
(Former name) Procurement of Drilling Equipment, Accessories and Spare Parts
(New name) Project for Improvement of Drinking Water

6. Japan's Grant Aid System

1) The Government of Sri Lanka has understood the system of Japan's Grant Aid, as described in **Annex III**, explained by the Team.
2) The Government of Sri Lanka will take necessary measure, as described in **Annex II** for the smooth implementation of the Project on condition that Japan's Grant Aid is extended to the Project.

7. Schedule of the Study

1) The consultants will proceed to further studies in Sri Lanka until January 31, 1996.
2) JICA will complete the final report and send it to the Government of Sri Lanka by March in 1996.

8. Existing Locations and Conditions of the Rigs

As a result of field surveys, the Team confirmed the conditions and locations of the rigs procured under Japan's Grant Aid. The existing conditions and locations are described in **Annex IV**.

Two rigs are abandoned owing to the heavy accident and fire. Three rigs are under repair at Head Office of NWSDB Ground Water Section and the Regional Office in Kalutara. Remaining eight rigs are working properly in each site.

NWSDB is making considerable efforts to maintain 11 rigs procured under the Japan's Grant Aid even after the long usage.

9. Management of Water Supply Facilities

Management of the water supply facilities completed in the rural areas will done by the beneficial community with the assistance of the respective local authority and the regional manager's office of NWSDB.

The Government of Sri Lanka promotes the above 3-TIER system that NWSDB are supporting the implementation.

10. Other Relevant Issues

1) The Government of Sri Lanka will allocate necessary budget and personnel for the Project.
2) NWSDB agreed to consider to add up some portion of the depreciation cost of the equipment into the operational cost for the sustainable use.

Annex I

Equipment List

No.	Name of Equipment	Specification	Q'ty	Priority
1- 1	Drilling Equipment	for Restricted Sites, light and compact design, air flush or DTH hammer drilling, with portable air compressor	1	A
1- 2A	Drilling Equipment	for Collapsible Earth Formation, with 1,000 liter/min, 24 kg/cm2 Mud Pump, and with 20 bar compressor for 10" DTH	2	A
1- 2B	Drilling Equipment	for Collapsible Earth Formation, with 730 liter/min, 19 kg/cm2 Mud Pump, and with 20 bar compressor for 10" DTH	2	A
1- 3A	Clay Cutter	for the above Drilling Equipment (4 units for the above and 2 units for stand-by)	6	A
1- 3B	Casing Clamps	for the above Drilling Equipment (4 units for the above and 2 units for stand-by)	6	A
1- 3C	Shackles	for the above Drilling Equipment (4 units for the above and 2 units for stand-by)	6	A
1- 4A	Tricone Bits	size 300 mm/12-1/4" for soft formation	8	A
1- 4B	Tricone Bits	size 270 mm/10-5/8" for soft formation	8	A
1- 4C	Tricone Bits	size 215 mm/8-1/2" for soft formation	8	A
1- 4D	Tricone Bits	size 300 mm/12-1/4" for medium hard formation	8	A
1- 4E	Tricone Bits	size 270 mm/10-5/8" for medium hard formation	8	A
1- 4F	Tricone Bits	size 215 mm/8-1/2" for medium hard formation	8	A
1- 4G	Bit Subs	for the above bits	*	A
1- 4H	Bit Breakers	for the above bits	*	A
1- 4I	Other Accessories for the bits such as Tong, etc.	for the above bits	*	A
1- 5A	Spare Parts	for light duty (No. 1-1) drilling machine	*	A
1- 5B	Spare Parts	for heavy duty drilling machines	*	A
1- 5C	Spare Parts	for air compressor for light duty rigs	*	A
1- 5D	Spare Parts	for air compressors for heavy duty rigs	*	A
1- 5E	Spare Parts	for mud pumps and engines for mud pumps	*	A

No.	Name of Equipment	Specification	Q'ty	Priority
1- 5F	Spare Parts	for DTH hammers	*	A
1- 5G	Spare Parts	for rig carriers	*	A
2- 1	Air Compressor	17 m3/min, 12 bar	4	A
2- 2	High Pressure Washing Machine	with Air Compressor	5	A
2- 3A	Garage Jacks	20 ton	5	A
2- 3B	Chain Blocks	5 ton	10	A
2- 4A	Drilling Hammers	DTH hammers for 100-300 mm	10	A
2- 4B	Drilling Hammers	DTH hammers for 105-150 mm	30	A
2- 4C	Drilling Hammers	DTH hammers for 127-165 mm	30	A
2- 4D	Drilling Hammers	DTH hammers cop 62 (Atlas Copco)	5	A
2- 4E	Drilling Hammers	DTH hammers cop 42 (Atlas Copco)	10	A
2- 4F	Drilling Hammers	Assembly and Disassembly tools for above 4A to 4F	*	A
2- 5A	Button Bits	size 105 mm	50	A
2- 5B	Button Bits	size 165 mm	50	A
2- 5C	Button Bits	size 203 mm	10	A
2- 5D	Button Bits	size 254 mm	8	A
2- 5E	Button Bits	size 127 mm	60	A
2- 5F	Button Bits	size 115 mm	100	A
2- 5G	Button Bits	size 191 mm	30	A
2- 6	Well Flushing Units	with 5 m3/min 7 bar compressor and air lift equipment for 4-1/2" dia and 50 m depth	4	A
2- 7	Spare Parts for Existing Equipment	for 11 units of Rigs, 7 units of Compressors, 3 units of Hino and 8 units of TCM Carriers	1 set	A
3- 1	Pick-up	4WD, double cabin and 750 kg loading capacity	15	A
3- 2	Cargo Truck	double cabin with 1,750 kg loading capacity	10	B
4- 1	Water Quality Field Testing Instrument	Ec, Ph, Eh, Na+, K+ Ca++, Mg++, Fe++, HCO3-, CO3--, SO4--, Cl-, NO3-, F-	7 sets	B
4- 2	Water Level Indicators	50 m	16	C
4- 3	Hand Augers	10 m	5	C

No.	Name of Equipment	Specification	Q'ty	Priority
4- 4A	Submergible pump	600 liter/min, 50 m	3	C
4- 4B	Centrifugal pump	1,000 liter/min 15m	3	C
4- 4C	Submergible pump	for heavy sand contents, 1,000 liter/min, 40 m	2	C
4- 5A	Generators	20 KVA, 3 phase, 50 Hz	2	C
4- 5B	Generators	33 kVA, 3 phase 50 Hz	2	C
4- 6	Air Compressors	8.5 m3/min, 7.0 kg/cm2, trailer mounted	1	C
4- 7	Spare Parts	for 4-4A, 4-4B, 4-4C, 4-5A, 4-5B, 4-6	1 set	C
4- 8	Global Positioning System	4 to 6 channel	6	C
4- 9	Geophysical Survey Instruments	EM and Terrameter	4 sets	C
4- 10	Conductivity meter	measuring range 10 micro mho/cm to 10,000 mho/cm	16	C
4- 11	Depth sampler	1 liter 50 m depth	16	C
5- 1	Hand Pumps	35m, MKIII, for riser pipe alkathiene	1,000	A

* Manufacturer's Standard

Annex II

Necessary measures to be taken by the Government of Sri Lanka on condition that Japan's Grant Aid is extended;

1. To provide data and information necessary for the Project,

2. To secure, clear, level and reclaim the sites for the Project,

3. To bear commissions to the Japanese foreign exchange bank to execute the banking services based upon the banking arrangement,

4. To ensure prompt unloading, customs clearance at port of disembarkation in Sri Lanka and facilitate internal transportation therein of the products purchased under the Grant,

5. To exempt Japanese Nationals from customs duties, internal taxes and other fiscal levies which may be imposed in Sri Lanka with respect to the supply of the products and services under the verified contracts,

6. To accord Japanese Nationals, whose services may be required in connection with the supply of the products and services under the verified contracts, such facilities as may be necessary for their entry into Sri Lanka and stay therein for the performance of their work,

7. To use and maintain properly and effectively all the equipment purchased under the Grant,

8. To bear all the expenses other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and the installation of the equipment.

Annex III

Japan's Grant Aid Scheme

1. Grant Aid Procedures

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

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

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

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

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

Fourthly, the Project, once approved by the Cabinet, becomes official with the Exchange of Notes signed by the governments of Japan and the recipient country.

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

2. Basic Design Study

1) Contents of the Study

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

A) Confirmation of the background, objectives, and benefits of the requested Project and also institutional capacity of agencies concerned of the recipient country necessary for the Project's implementation.

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

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

D) Preparation of a Basic Design of the Project

E) Cost Estimation of the Project

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

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

2) Selection of Consultants

For smooth implementation of the Study, JICA uses (a) registered consultant firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms. The firm(s) selected carry(ies) out a Basic Design Study and write(s) a report, based upon terms of reference set by JICA.
The consulting firm(s) used for the Study is (are) recommended by JICA to the recipient country to also work on the Project's implementation after the Exchange of Notes, in order to maintain technical consistency and also to avoid any undue delay in implementation should the selection process be repeated.

3. Japan's Grant Aid Scheme

1) What is Grant Aid?

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

2) Exchange of Notes (E/N)

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

3) "The period of the Grant Aid" means the one fiscal year for which the Cabinet approves the Project. Within that fiscal year, all procedures such as Exchange of Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed.
However in case of delays in delivery, installation or construction due to unforeseen factors such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two governments.

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

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

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

5) Necessity of "Verification"

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

6) Undertakings required of the Government of the Recipient Country

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

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

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

C) To secure buildings prior to procurement where required for the installation of the equipment .

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

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

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

G) "Proper Use"

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

H) "Re-export"

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

I) Banking Arrangement (B/A)

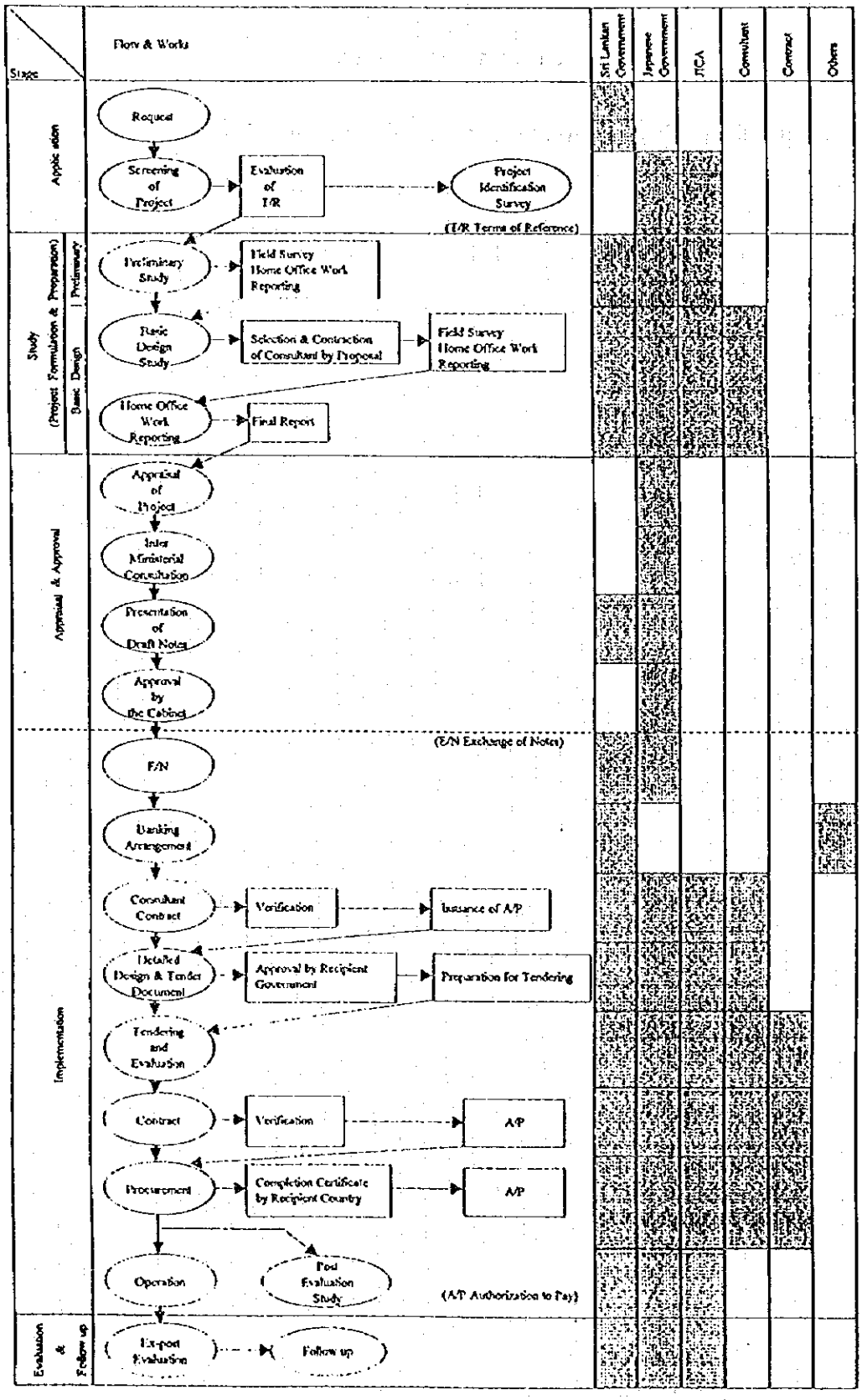
① The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan (hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country to its designated authority under the Verified Contracts.

② The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.

Grant Aid Procedure

The contents of Japan's Grant Aid Procedures are as follows:

Flow Chart of Japan's Grant Aid Procedures



Major Undertakens by Each Government

No	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land		O
2	To clear, level and reclaim the site when needed		O
3	To construct gates and fences in and around the site		O
4	To construct the parking lot	●	
5	To construct roads		
	1) Within the site	●	
	2) Outside the site		O
6	To construct the buildings	●	
7	To provide facilities for the distribution of electricity, water supply, drainage and other incidental facilities		
	1) Electricity		
	a. The distributing line to the site		O
	b. The drop wiring and internal wiring within the site	●	
	c. The main circuit breaker and transformer	●	
	2) Water Supply		
	a. The city water distribution main to the site		O
	b. The supply system within the site (receiving and elevated tanks)	●	
	3) Drainage		
	a. The city drainage main (for storm, sewer and others) to the site		O
	b. The drainage system (for toilet sewer, ordinary waste, storm drainage and others) within the site	●	
	4) Gas supply		
	a. The city gas main to the site		O
	b. The gas supply system within the site	●	
	5) Telephone System		
	a. The telephone trunk line to the main distribution frame/panel (MDF) of the building		O
	b. The MDF and the extension after the frame/panel	●	
	6) Furniture and Equipment		
	a. General furniture (carpets, curtains, tables, chairs and others)		O
	b. Project equipment	●	
8	To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the B/A		
	1) Advising commission of A/P		O
	2) Payment commission		O
9	To ensure unloading and customs clearance at port of disembarkation in recipient country		
	1) Marine (Air) transportation of the products from Japan to the recipient country	●	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		O
	3) Internal transportation from the port of disembarkation to the project site		O
10	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contact such facilities as many be necessay for their entry into the recipient country and stay therein for the performance of their work		O
11	To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the supply of the products and services under the verified contracts		O
12	To maintain and use properly and effectively the facilities constructed and equipment procured under the verified contracts		O
13	To bear all the expenses, other than those to be borne by the Grant, necessary for construction of the facilities as well as for the transportation and installation of the equipment		O

Annex IV

Existing Conditions and Locations of the Rigs

25 January, 1996

No.	Rig No.	Type	Rig Plate No.	Year Donated	Location	Condition
1	DR-4	Tone top 200	28/8925	1983	Kalutara	Working
2	DR-5	Tone top 200	28/8926	1983	Kurunegala	Working
3	DR-6	Tone top 200	28/8927	1983	Head Office	Under Repair
4	DR-7	Tone top 150	40/5578	1984	Anuradhapura	Working
5	DR-8	Tone top 150	40/5602	1984	Embilipitiya	Working
6	DR-9	Tone top 150	40/5603	1984	Kalutara	Under Repair
7	DR-10	Tone top 150	40/5604	1984	Head Office	Abandoned
8	DR-11	Tone top 150	40/5605	1984	Kalutara	Working
9	DR-12	Tone top 150	40/5606	1984	RSC Matara	Working
10	DR-13	Tone top 150	40/5607	1984	Head Office	Under Repair
11	DR-14	Tone top 150	40/5608	1984	Anuradhapura	Working
12	DR-15	Tone top 150	40/5609	1984	Head Office	Abandoned
13	DR-16	Tone top 150	40/5610	1984	Kurunegala	Working

Appendix 5

List of Data and Reports Collected

No.	*Title*	*Issued by*	*Year*
1	Public Investment Programme 1995 - 1999	National Planning Department	1995
2	Kandy District Water Supply and Sanitation Project Phase II, Final Report	Finish International Development Agency (FINNIDA), NWSDB	1995
3	Impact Evaluation of the Rural Water Supply and Sanitation Project in Sri Lanka	DANIDA	1995
4	Statistical Abstract, 1994	Ministry of Planning, Ethnic Affairs and National Integration, Department of Census and Statistics	1995
5	National accounts of Sri Lanka, 1994	Ministry of Planning, Ethnic Affairs and National Integration, Department of Census and Statistics	1995
6	Consumer Self Evaluation Survey of DANIDA Assisted Rural Water Supply and Sanitation Project in Matale, Polonnaruwa and Anuradhapura Districts	National Water Supply and Drainage Board (NWSDB)	1995
7	Integrated Rural Development Programme, Assets Directory, up to end of 1994	Regional Development Division, Ministry of Planning, Ethnic Affairs and National Integration	1995
8	Small Towns Water Supply Programme(STWSSP), Pilot Project Proposal for Six Small Towns	Rural Water Supply Division, NWSDB	1995
9	Healthy Village Programme in Eluwampitiya with Assistance from WHO, Community Action Planning	Rural Water Supply Division, NWSDB	1995
10	Water Supply and Sanitation Related Information 1992, Volume 1, National Level (except North East Province)	NWSDB, sponsored by UNICEF	1994
11	Water Supply and Sanitation Related Information 1992, Volume 2, Western Province	NWSDB, sponsored by UNICEF	1994
12	Water Supply and Sanitation Related Information 1992, Volume 3, Central Province	NWSDB, sponsored by UNICEF	1994
13	Water Supply and Sanitation Related Information 1992, Volume 4, Southern Province	NWSDB, sponsored by UNICEF	1994
14	Water Supply and Sanitation Related Information 1992, Volume 5, North Western Province	NWSDB, sponsored by UNICEF	1994
15	Water Supply and Sanitation Related Information 1992, Volume 6, North Central Province	NWSDB, sponsored by UNICEF	1994
16	Water Supply and Sanitation Related Information 1992, Volume 7, Uva Province	NWSDB, sponsored by UNICEF	1994

No.	*Title*	*Issued by*	*Year*
17	Water Supply and Sanitation Related Information 1992, Volume 8, Sabaragamuwa Province	NWSDB, sponsored by UNICEF	1994
18	Self Employment within a Framework of 'Structural Adjustment'	SLAE-SIDA Research Project	1994
19	Master Plan for Water Supply and Sanitation, Volume I, Anuradhapura District	DANIDA	1993
20	Master Plan for Water Supply and Sanitation, Volume II, Anuradhapura District	DANIDA	1993
21	Master Plan for Water Supply and Sanitation, Volume III, Anuradhapura District	DANIDA	1993
22	Master Plan for Water Supply and Sanitation, Annexes, Anuradhapura District	DANIDA	1993
23	Mapping High Fluoride Content in Groundwater Sri Lanka	World Health Organization (WHO) and NWSDB, Ratmalana	1987
24	Computer Data Output for Boreholes Drilled in Kurunegala District, Sri Lanka (1980-1985)	World Health Organization (WHO) and NWSDB	1986
25	Case Studies on Hydrogeological Investigations on Hard Rocks for Community Water Supplies in Sri Lanka, Special Papers, Volume II	World Health Organization (WHO) and NWSDB	1985
26	Case Studies on Hydrogeological Investigations on Hard Rocks for Community Water Supplies in Sri Lanka, Volume I	World Health Organization (WHO) and NWSDB	1984
27	Reduction of Iron in Groundwater Using a Low-cost Filter Unit	Kandy District Water Supply and Sanitation Project, Journal of the Geological Society of Sri Lanka, Vol 3	-
28	A Simple Defluoridator for Removing Excess Fluorides from Fluoride-rich Drinking Water	International Journal of Environmental Health Research 5	1995
29	Development of Low Cost Domestic Defluoridator	NWSDB, Regional Laboratory, Sarasavivuyana - Peradeniya	-
30	Hydrogilogical Parameters in 7 Divisions, Kurunegala District(7 sheets)	Water Resources Board	-
31	Geohydrogilogical Parameters in 7 Divisions, Kurunegala District(7 sheets)	Water Resources Board	-
32	Ground Water Project Progress, Annual Report, 1994	Ground Water Section, NWSDB	1995
33	Ground Water Project Progress, Annual Report, 1993	Ground Water Section, NWSDB	1994
34	Ground Water Project Progress, Third Quarterly Report, 1995	Ground Water Section, NWSDB	1995
35	Ground Water Project Progress (Monthly), January - December, 1995	Ground Water Section, NWSDB	1995

The New Delhi Statement

The New Delhi Statement is an appeal to all nations for concerted action to enable people to obtain two of the most basic human needs — safe drinking water and environmental sanitation.

The Statement was adopted by 600 participants from 115 countries at the Global Consultation on Safe Water and Sanitation for the 1990s held in New Delhi, from 10 to 14 September 1990. Organized by the United Nations Development Programme and hosted by the Government of India, the Consultation was co-sponsored by the UN Steering Committee for The International Drinking Water Supply and Sanitation Decade and by the Water Supply and Sanitation Collaborative Council.

"Some for all rather than more for some."

New Delhi, India, 14 September 1990

Safe water supplies and environmental sanitation are vital for protecting the environment, improving health, and alleviating poverty. Disease, drudgery and millions of deaths every year are directly attributable to lack of these essential services. The poor, especially women and children, are the main victims.

Concerted efforts during the 1980s brought water and sanitation services to hundreds of millions of the world's poorest people. But even this unprecedented progress was not enough. One in three people in the developing world still lack these two most basic requirements for health and dignity.

Every developing country learned its own lessons during The International Drinking Water Supply and Sanitation Decade (1981-1990). The global community must now more effectively combine these experiences with a renewed commitment to sustainable water and sanitation systems for all. Access to water and sanitation is not simply a technical issue; it is a crucial component of social and economic development. Sustainable and socially acceptable services can be extended by using appropriate technologies, adopting community management and enhancing human resources.

Political commitment is essential and must be accompanied by intensive efforts to raise awareness through communication and mobilization of all sections of society.

Challenge

Entering the 1990s, governments face formidable challenges: Population growth continues apace. Infrastructure in many cities is stretched to the breaking point. Uncontrolled pollution is putting greater stress on the living environment. Depletion and degradation of water resources are causing the costs of new water supplies to escalate. Without fundamentally new approaches, the broad-scale deprivation will turn into an unmanageable crisis..

Creating the right conditions for accelerated progress will often involve profound institutional, economic and social changes, as well as reallocation of resources and responsibilities at all levels.

To achieve full coverage by the year 2000 using conventional technologies and approaches would require five times the current level of investment. However, there is a realistic two-pronged alternative:

- Substantial reduction in costs of services, through increased efficiency and use of low-cost appropriate technologies.
- Mobilization of additional funds from existing and new sources, including governments, donors and consumers.

If costs were halved and financial resources at least doubled, universal coverage could be within range by the end of the century.

Guiding Principles

For countries taking up this challenge — *Some for all, rather than more for some,* the New Delhi Global Consultation recommends four Guiding Principles:

- Protection of the environment and safeguarding of health through the integrated management of water resources and liquid and solid wastes.
- Institutional reforms promoting an integrated approach and including changes in procedures, attitudes and behaviour, and the full participation of women at all levels in sector institutions.
- Community management of services, backed by measures to strengthen local institutions in implementing and sustaining water and sanitation programmes.
- Sound financial practices, achieved through better management of existing assets, and widespread use of appropriate technologies

Principle No. 1: The Environment and Health

Safe water and proper means of waste disposal are essential for environmental sustainability and better human health, and must be at the center of integrated water resources management.

Rapid population growth and accelerating urbanization, threaten health and the environment, presenting governments with daunting challenges in the 1990s. The poor, especially women and children, will continue to be the hardest hit.

Every day, water-related diseases cause the deaths of thousands of children, and untold suffering and loss of working time for millions. Safe water combined with improved hygiene and better nutrition can reduce, and sometimes even eliminate these diseases.

The dramatic reduction of *dracunculiasis* (Guinea worm disease) has resulted from the provision of improved water supplies and hygiene education in endemic areas. The target of total eradication by 1995 should be fully supported. Affected countries should accord it high priority in investment programmes.

Toxic and industrial wastes pose increasing dangers to the environment in developing countries. They represent a significant threat to human health through direct contact and the pollution of water and soil. Governments and responsible agencies must take steps to control these health hazards.

Improvements to the household environment can be best achieved through the community's involvement as an equal partner with government and sector agencies. This means building on indigenous knowledge, so that policies and programmes are credible and relevant to the beneficiaries. Emphasis must be placed on education, social mobilization and community participation.

Proper drainage and disposal of solid wastes have a major impact on the neighbourhood environment. New solutions are needed which are environmentally appropriate and affordable to the communities they serve and which also conserve water resources and minimize pollution.

Integrated water resources management is necessary to combat increasing water scarcity and pollution. This includes water conservation and reuse, water harvesting, and waste management. An appropriate mix of legislation, pricing policies and enforcement measures is essential to optimise water conservation and protection.

Principle No. 2: People and Institutions

Strong institutions are essential for sustainable development.

They require sound management, motivated people and an enabling environment of appropriate policies, legislation and incentives. Institutional development takes time. The short-term achievement of production targets should not take precedence over the need for capacity building. The overall objective is achieving sustainable facilities which are used effectively by the beneficiaries.

A changing role of government is envisaged, from that of provider to that of promoter and facilitator. This will enable local public, private and community institutions to deliver better services. Decentralization demands a strong policy and support role from central governments, while local private enterprise can assist in improving the efficiency and expansion of service delivery.

The special role in development of non-governmental organizations (NGOs) and of volunteers must be acknowledged and strengthened. NGOs are flexible, credible, ready and able to experiment with innovative approaches. Governments should support the NGOs in replicating these approaches, and include NGOs, wherever appropriate, as partners in projects.

Human resources development (HRD) at all levels, from community members to politicians, is essential to institutional development. Training of professionals, managers, technicians and extension workers builds competence and confidence. Information, education and communication strategies must be integrated within HRD policies. Women must be trained and guaranteed equal

employment opportunities at all levels of staff and management. National professional associations can play an important role in better HRD.

Education is a key part of the new approach. Schools offer a vast, most receptive audience for hygiene education. Polytechnics and universities already include water and sanitation related subjects in their curricula, but must be encouraged to respond to this sector's needs for multi-disciplinary skills. Sanitary and environmental engineering curricula should incorporate substantial elements of community development, communications, appropriate technology, and project management.

Principle No. 3: Community Management

Community management goes beyond simple participation. It aims to empower and equip communities to own and control their own systems.

Community management is a key to sustaining services for the rural poor and is a viable option for poor urban settlements. Governments should support community management, through legislation and extension, and give it priority in national sector strategies for the 1990s.

Communities should have prominent roles in planning, resource mobilization, and all subsequent aspects of development. Within these strategies, gender issues will be all important. Women should be encouraged to play influential roles in both water management and hygiene education. Capacity building is necessary to make community management effective and enable women to play leading roles.

Linkages must be established to ensure that national plans and programmes are responsive to community needs and desires. Methods for evaluating community management have been developed for rural areas. They should now be adopted at the national level and implemented through participatory monitoring and evaluation techniques.

Principle No. 4: Finance and Technology

Given the number of people unserved and the growing demand, more effective financial strategies must be adopted in the 1990s for the long-term sustainability of the sector.

Current levels of investment in the sector are about US$10 billion per year.It is estimated that approximately $50 billion a year would be needed to reach full coverage by the year 2000, using conventional approaches. Such a five-fold increase is not immediately feasible.

New strategies should aim towards two key objectives:

- increased efficiency in the use of available funds;
- mobilization of additional funds from existing and new sources, including governments, donors and consumers.

Substantially increased effectiveness in the use of financial resources can yield major gains in sustained coverage. This will require changes in the way service agencies operate, to make them more cost-effective and responsive to consumer needs and demands. Involving consumers in choice of technology and service levels has proved to have a positive impact on cost recovery and sustainability.

A powerful case can be made for greater government and external support agency support. However, economic and social benefits need to be better quantified. Clear sector strategies and action plans increase the likelihood of water and sanitation programmes receiving higher priority in national planning processes. They may also make the sector more attractive for support from external support agencies (ESAs).

The high debt burden of many developing countries makes it particularly difficult for them to consider loans at market interest rates for all investments in this sector. With this in mind, lending agencies and donors are urged to look favourably on requests for grants or soft loans to support water and sanitation programmes. ESAs can also help by developing procedures or guidelines which will reduce project preparation and approval time. Support should also be given for the establishment of financial intermediaries to make credit more widely available.

Restructuring the utilization of funds for sector investments and setting of user charges are key issues in sector finance. Maximum benefits can be accrued by allocating a higher proportion of funds to affordable and appropriate projects in rural and low-income urban areas, where needs are greatest.

Rehabilitation of defective systems, reductions in wastage and unaccounted for water, recycling and reuse of wastewater, and improved operation and maintenance can often be more effective than investment in new services. Choices of technology and levels of service are major factors in determining construction, operation and maintenance costs of new projects. Due attention must be given to operation and maintenance arrangements which will ensure sustainability before investments are made.

Higher budget allocations and recovery of recurrent costs of operation and maintenance to ensure system sustainability are primary goals to be achieved. Effective cost recovery requires that

sector institutions be given autonomy and authority. Further, there must be widespread promotion of the fact that safe water is not a free good. Appropriate charging mechanisms must be adopted, which reflect local socio-cultural and economic conditions. Collection should be decentralized so that revenues are available for management and operation of services.

Public sector institutions frequently default on payments for water supply and waste disposal services. For reasons of financial viability and equity, this practice is unacceptable. Increasing collection efficiency must be part of better financial management.

Research and development in developing countries has resulted in widespread application of much improved handpump and on-site sanitation technologies. The momentum established during the 1980s must be maintained and increased in the next ten years. Among the priority needs for the 1990s are improved household technologies for protecting water quality from source to mouth and low-cost wastewater disposal systems for low-income urban areas. Exchanges of information and experience among developing countries (South-South co-operation) must be further developed.

Follow-up

Implementation of the approaches outlined in this Statement will need to be part of country specific strategies.

Countries and ESAs are urged to formulate and implement action plans for water and sanitation incorporating the Guiding Principles of the New Delhi Statement. UNDP is invited to take a leading role in this process, in collaboration with other UN agencies.

The Water and Sanitation Collaborative Council, created immediately prior to the New Delhi Global Consultation, offers a new global forum for the exchange of information and promotion of the sector.

This New Delhi Statement will be reflected in a document to be presented to the World Summit for Children in late September 1990, along with a UNICEF-initiated statement on behalf of children, which was adopted at the Global Consultation.

The New Delhi Statement will be presented by the Government of India to the 45th session of the United Nations General Assembly in October 1990.

In addition, it is recommended that this Statement be brought to the attention of the organizers of the 1992 United Nations Conference on Environment and Development in Brazil, with a request that it be tabled to emphasize the special importance of water and sanitation in environmental management.

Note: The Secretariat wishes to thank the delegations which have expressed strong views on such issues as institutional development, allocation of resources, efficiency, cost recovery, and operation and maintainance.

JICA