CHAPTER 3 WATER SUPPLY CONDITIONS AND WATER USAGE

3.1 EXISTING WATER SUPPLY SCHEME

In Hambantota district, the monthly production amount is 822,250 m^3 (the surface water is main source), which is only 3% of the total production amount of whole Sri Lanka. In Monaragala district, the monthly production amount is less than that of Hambantota.

In the Study area, 30 water supply schemes are operated by NWSDB and local administrative organization (Pradeshiya Sabha). These schemes supply water to about 234,000 people in both districts.

3.1.1 HAMBANTOTA DISTRICT

In Hambantota district, 19 water supply schemes are operated by NWSDB. The local authorities of Pradeshiya Sabha operate two water supply schemes. Total population served by these water supply schemes is at least 170,851, which corresponds to 33% of the total population of Hambantota district.

There are five schemes sourcing water by wells and two schemes sourcing water by springs with partial treatment. These schemes depend on groundwater sources. The groundwater covers only 10% of total population supplied water by schemes.

The locations of water supply schemes in the Hambantota district are shown in *Figure 3.1*. *Figure 3.2* shows the coverage rate by water supply schemes at each GND. In Hambantota district, the covered area is mainly distributed along the coastal area and west part of the district.

3.1.2 MONARAGALA DISTRICT

In Monaragala district, six water supply schemes are operated by NWSDB. The local authorities of Pradeshiya Sabha operate three schemes. Total population served by these water supply schemes is at least 63,394, which corresponds to 16% of the total population of Monaragala district.

The water sources of the schemes are rivers and tanks except in Buttala water supply scheme. The only scheme in Buttala has extracted water from a river and two wells since 1992. Each scheme has a treatment facility for distribution. Out of seven Pilot GNDs, only a part of Yalabowa in Wellawaya DSD, is covered by the water supply scheme.

Locations of covered areas are dispersed as shown in *Figure 3.1*. The numbers of GND covered by schemes is less than that of Hambantota (See, *Figure 3.2*).

3.2 IRRIGATION AND INDUSTRIAL USE

3.2.1 IRRIGATION

In Hambantota and Monaragala districts, with a total area of 8,284 km^2, a considerable portion is used for forestry and agricultural purposes such as tea, rice and crop cultivation. Surface water such as river and tank water is mainly used for irrigation of rice and other crops. The areas for these purposes are 2,038 km^2 (36%) in Monaragala and 1,024 km^2 (39%) in Hambantota (NWSDB, 1999 and PIU, 2000). The total amount of water consumption for irrigation purpose in Monaragala is twice that of Hambantota.

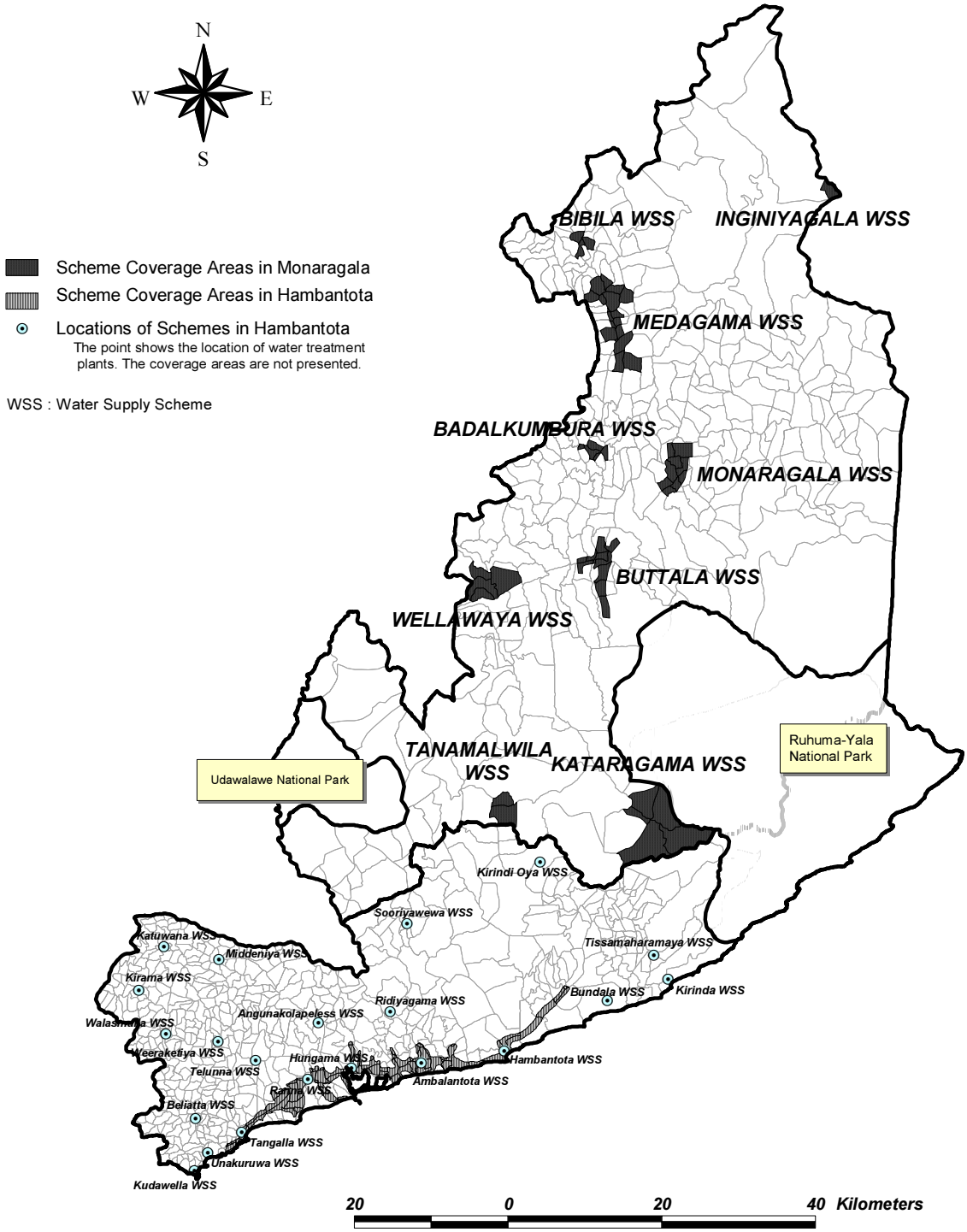

FIGURE 3.1 COVERED AREA BY EXISTING WATER SUPPLY SCHEME

THE STUDY ON COMPREHENSIVE GROUNDWATER RESOURCES DEVELOPMENT	JICA

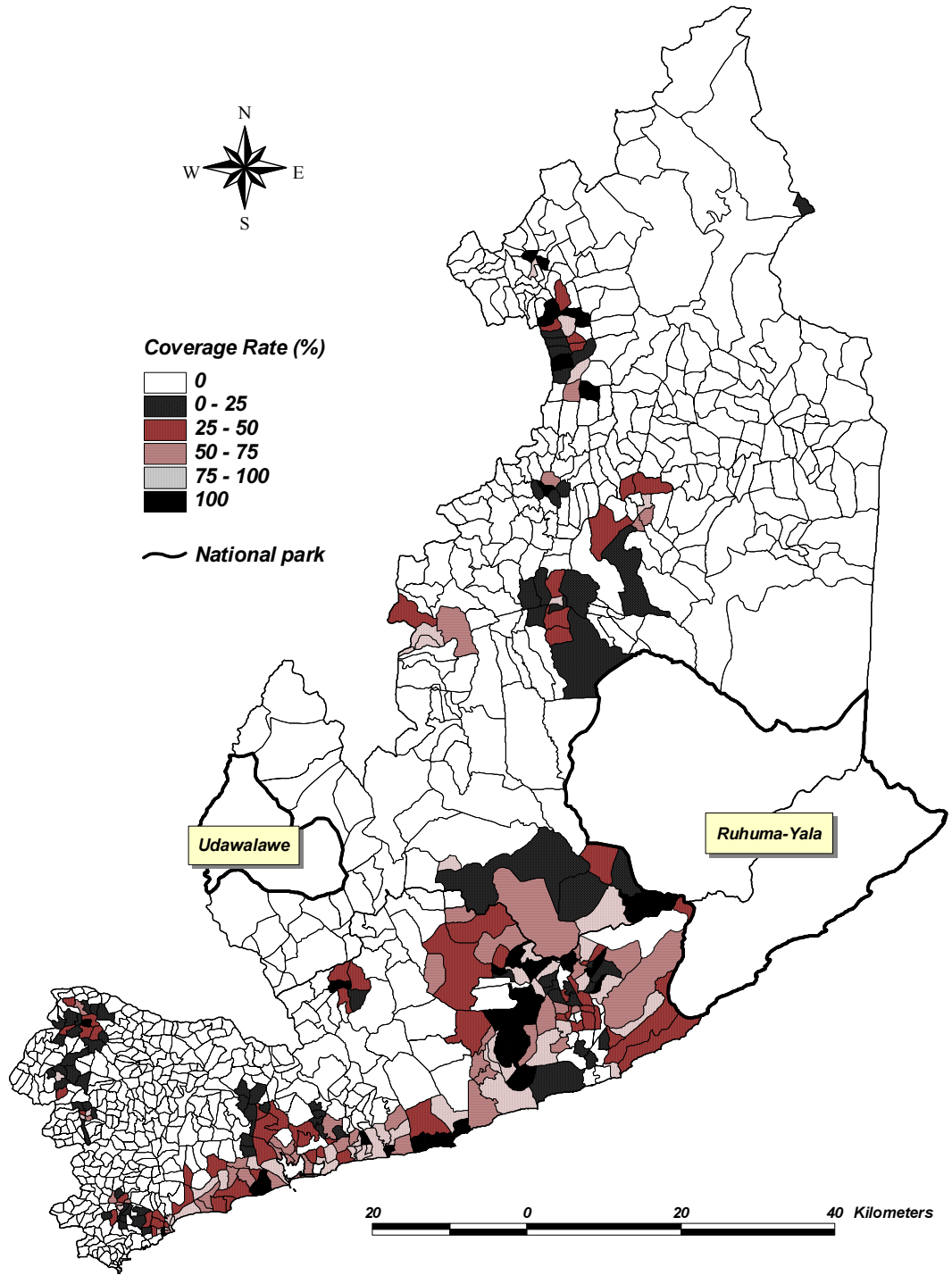

FIGURE 3.2 COVERAGE BY EXISTING WATER SUPPLY SCHEME AT GND

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The largest reservoir of in the Study area is Lunugamvehera tank, that is located on the border between Hambantota and Monaragala district, has utilized approximately 200 million m^3 of water every year.

3.2.2 INDUSTRY

In Hambantota district, 1,000 m^3/day of water is consumed by the industrial sector. This amount corresponds to about 4% of water produced by NWSDB in the district. The water is distributed by pipe with 48 connections in the district.

On the other hand, there is no industrial water consumption in Monaragala district. According to NWSDB, the production amount in the district is not enough to supply water to the industrial sector.

3.3 TYPE OF DOMESTIC WATER SOURCE

The groundwater, which is extracted from tube wells, dug wells and springs, is mainly utilized for the domestic purposes. The surface water, which is extracted from rivers, streams and tanks, is mainly utilized for an irrigation purpose. NWSDB (1997a, 1997b) classified water sources for drinking purpose in Hambantota and Monaragala districts, based on the results of demographic survey done by Department of Census and Statistics (1994).

In Monaragala district, the ratio of population served by "House Connection and Stand Post" is 12%. This ratio is lower than Hambantota district of 28% (as shown in *Figure 3.3*). On the other hand, the ratio of population served by "others" sources that includes river, tank and stream, is higher than Hambantota district. This result reveals that the water supply condition of Hambantota district is rather more advanced than Monaragala, in terms of adoption rate of pipe water supply condition.

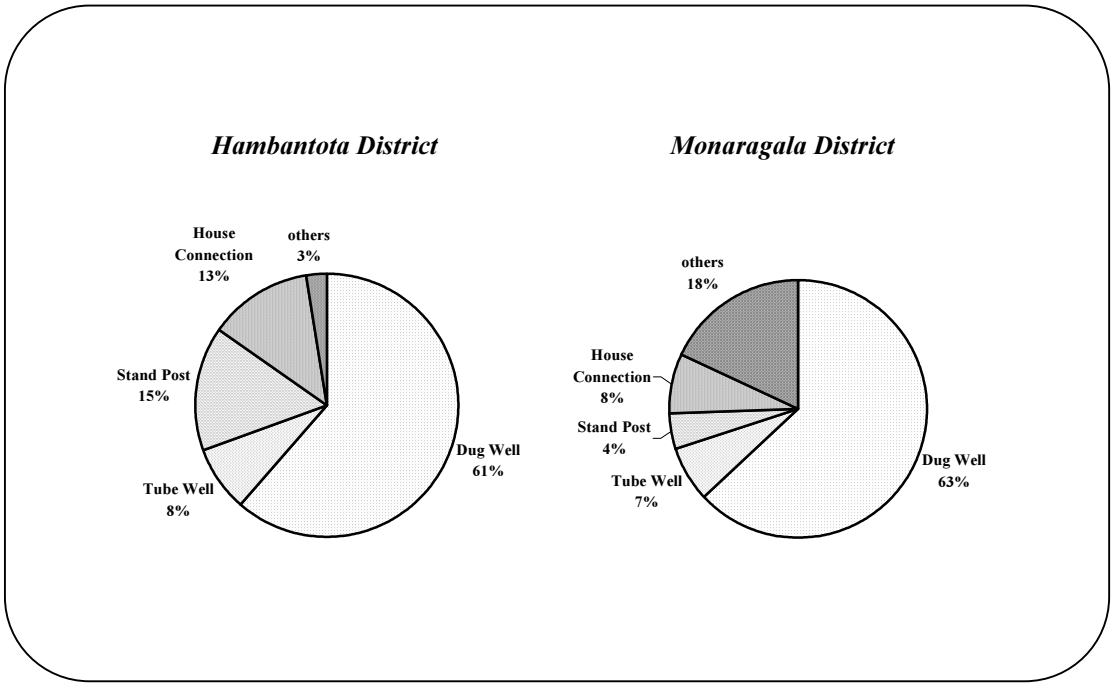


Figure 3.3 Ratio of Water Source in Hambantota and Monaragala

Source: Department of Census and Statistics (1996) Demographic Survey 1994 Sri Lanka, Report on Housing and Basic Amenities, Release 2

3.4 FUTURE PLAN (INCLUDE ONGOING PROJECT)

In Hambantota and Monaragala districts, the small-scale water supply project has been implemented by NWSDB. The types of water source in the project are house connection, tube well and dug well.

In Hambantota district, 78 GNDs will be covered by pipe water supply by the end of year 2004. In Monaragala district, residents in 68 GNDs will be supplied water by the planned project by the end of year 2002. Out of these GNDs, house connection water supply is planned for 27 GND. The water supply coverage that will be increased by these ongoing projects is taken into consideration in the future water demand projection.

3.5 WATER USAGE

3.5.1 GENERAL CONDITIONS OF WATER SUPPLY IN THE STUDY AREA

To understand the general conditions of water supply, questionnaire survey was carried out.

(1) Hambantota District

The average water consumption rate is 19 liter/day/capita in Hambantota district, which is lower than that of Monaragala district of 35 litre/day/capita. Under such water supply conditions, 28.5% of surveyed people felt satisfaction and 71.5% dissatisfaction, in terms of quantity of water supply.

Willingness to pay for water supply was analyzed. In Hambantoa, the peak is a range of 21 to 80 Rs/month at monthly income of less than 4,000 Rs. It can be characterized as a middle range, while the Monaragala district is lower, less than 40 Rs/month. Considering the lower water consumption rate in Hambantota district, it is suggests that the reason of high willingness to pay in the district is because of less availability of water.

(2) Monaragala District

Average water consumption rate estimated is 35 liter/day/capita in Monaragala district. For the above water supply conditions, 46% of surveyed people felt satisfaction and 54% dissatisfaction, in terms of quantity. However, there is no significant difference between the two groups.

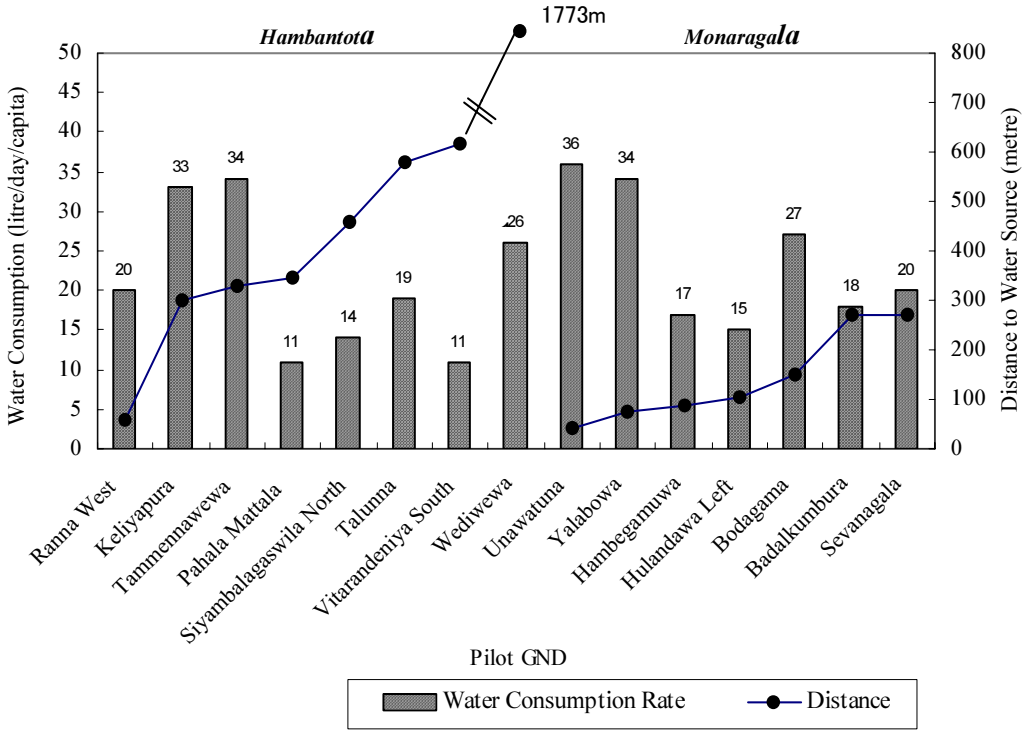
The range of the willingness to pay for the water supply in Hambantoa is less than 40 Rs/month at monthly income of less than 4,000 Rs/month. Very low willingness to pay is observed in the income level of less than 2,000 Rs/month which is the majority group in the district.

3.5.2 WATER CONSUMPTION AND DISTANCE TO MAJOR DOMESTIC WATER SOURCES

Water consumption rate shows a range between 11 to 34 liter/day/capita at Pilot GNDs in Hambantota district, and a range between 15 to 36 liter/day/capita at Pilot GNDs in Monaragala district (See, *Figure 3.4*). These results reveal that the condition of water consumption at Pilot GNDs in Hambantota district is worse than that of Pilot GNDs in Monaragala district.

According to the Design Criteria provided by NWSDB, designed rate of domestic use for the “stand post” is 45 liter/day/capita. As compared to this design rate, the water consumption rate obtained by this survey in the Pilot GNDs in Hambantota and Monaragala districts corresponds to one-quarter to three-quarter of the design rate.

The water consumption rate decreases as distance to the water source increases (See, *Figure 3.4*). The distances to the water source at Hambantota district are generally longer than that in Monaragala district. This result suggests that the accessibility to the water source at Hambantota district is lower than that at Monaragala district with minor exceptions.



Source: Results of Questionnaire survey in this study

Figure 3.4 Relationship between Distance to Water Source and Water Consumption Rate

3.5.3 WATER SOURCES

The distribution of five major types of water source (namely, dug well, tube well, stand post, house connection and others) are examined at each Pilot GND. The "others" includes surface water such as river, stream and tank, and bowser water supply.

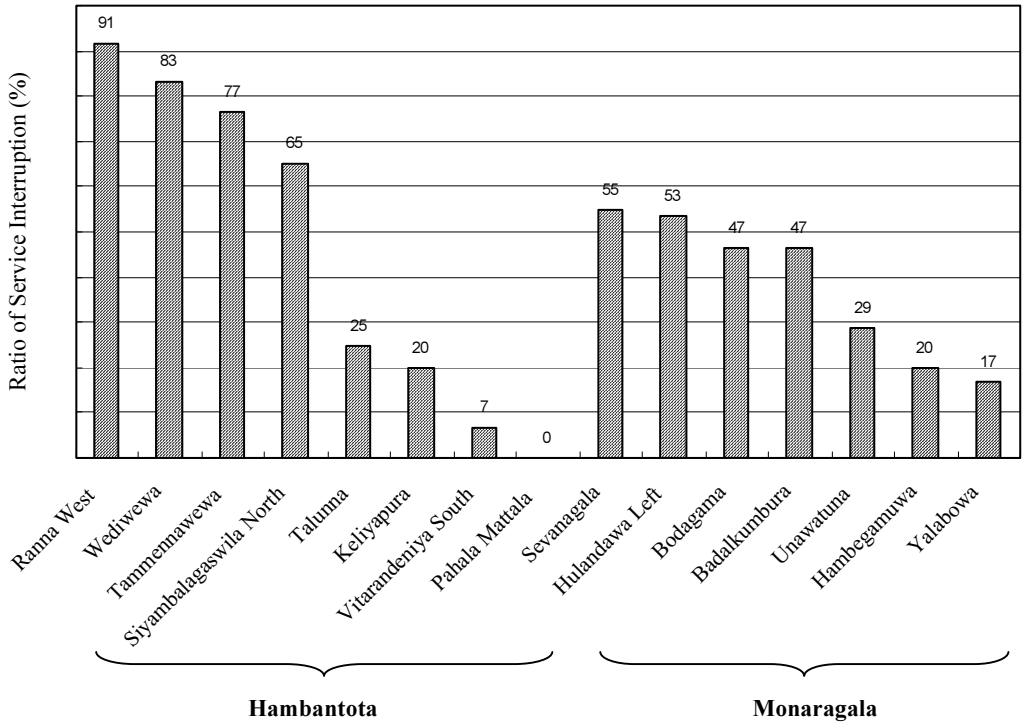
In Hambantota district, more than 80% of families in three GND (Ranna West, Pahala Mattala and Tammennawewa) depend mainly on stand post. On the other hand, the majority of the water source at other GNDs is dug well. In the case of Talunna and Siyambalagaswilla North, percentage of dug well is more than 90%.

The poor accessibility to the water source is noted at Wediwewa where the percentage of "others" in the GND is 20%, which is apparently higher than other GNDs.

In Monaragala district, more than 70% of families depend for their water source on dug well, except in Yalabowa. In Yalabowa, about 60% families are supplied domestic water through stand post, but the ratio of dug well is not small; it is still over 40%.

3.5.4 CONDITION OF WATER SOURCE IN DRY SEASON

To understand the condition of water source in dry season, the ratio of the service interruption and "dried up" is examined. As shown in the *Figure 3.5*, the ratio of service interruption and dried up in the Pilot GNDs in Hambantota district is higher than that of Monaragala district.



Source: Results of questionnaire survey in this study

Figure 3.5 Ratio of Service Interruption and Dried Up of Water Source

In Hambantota district, the ratio of service interruption and dried up in two GNDs (Ranna West and Tammennawewa) exceeds 80%, although the major water source is stand post. On the other hand, in the Pahala Mattala, there is no service interruption and dried up at either stand post and dug well. This fact suggests that the stability of the service for the water supply scheme depends largely on its water source.

CHAPTER 4 HYDROGEOLOGY

4.1 GENERAL

This chapter describes the results of the hydrogeological study. Based on the results, two hydrogeological maps have been prepared: namely, the hydrogeological maps for the upper fractured aquifer, *Figure 4.1(1)*, and for the lower and deeper fractured aquifer, *Figure 4.1(2)*.

4.2 AQUIFER CATEGORIES AND YIELD

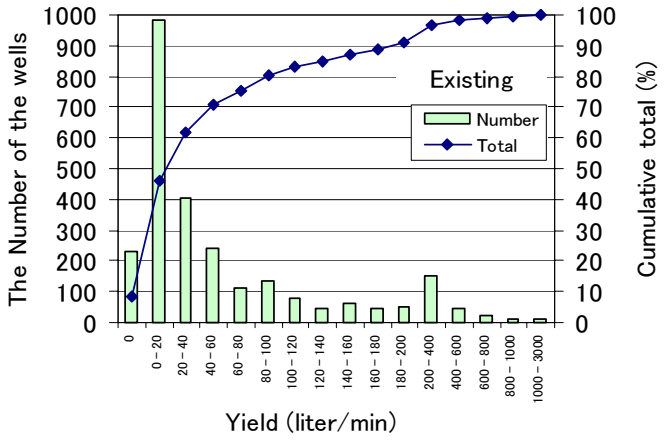
4.2.1 CATEGORY OF AQUIFER

There are two types of aquifer in the area. One is the shallow aquifer occurring in the subsurface deposits overlying the basement rock. Further development potential is practically limited. The other is the aquifer occurring in the fractured or weathered zone in the basement rock. The above results show the aquifers can be practically classified into three categories to consider a future groundwater development in the area, though a network of fractures in the basement rock, or a fractured aquifer system, is not clear yet. These categories are;

- Upper fractured aquifer A fractured aquifer already exploited in the depth to about 70 m
- Lower fractured aquifer A deep fractured aquifer in the depth from 70 to 100 m
- Deeper fractured aquifer A deeper aquifer in the depth from 100 to 200 m

4.2.2 UPPER FRACTURED AQUIFER (FRACTURED AQUIFER, 0 TO 70 M. IN DEPTH)

2625 wells, which is 92.3 % of the total number of existing wells, are 70 meters or less in depth. *Figure 4.2* shows the number of wells classified by yield. There are 519 wells (19.8 %) yielding more than 100 litres/min, which can be extracted by a submersible pump if necessary.



Yield (liter/min)	Number of Wells	Accumulating Total	
		No.	%
0	228	228	8.7
0 - 20	981	1209	46.1
20 - 40	407	1616	61.6
40 - 60	239	1855	70.7
60 - 80	115	1970	75.0
80 - 100	136	2106	80.2
100 - 120	79	2185	83.2
120 - 140	47	2232	85.0
140 - 160	60	2292	87.3
160 - 180	43	2335	89.0
180 - 200	51	2386	90.9
200 - 400	151	2537	96.6
400 - 600	45	2582	98.4
600 - 800	20	2602	99.1
800 - 1000	9	2611	99.5
1000 - 3000	14	2625	100.0

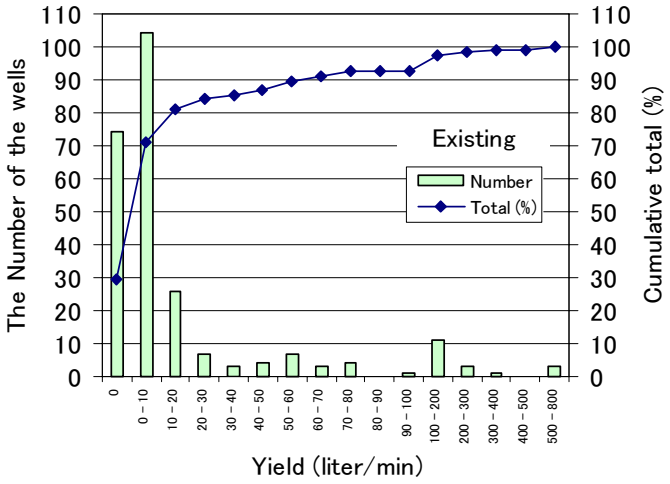
Figure 4.2 Number of Wells Classified by Yield

(Upper Fractured Aquifer, 0 to 70 m in Depth)

The hydrogeological map, *Figure 4.1(1)*, shows that the areas where wells are expected to yield more than 100 litres/min are located in the western end of Hambantota, and the south end, middle, and eastern area of Monaragala. Three test wells, No.H-5 (Pahala Mattala), M-1 (Sevanagala), M-2 (Bodagama) encountered productive fractures above the depth of 50 m. The fractures yielded from 240 to 400 litres/min during drilling. No.M-4 (Yalabowa) encountered fractures at the depth of 56 m, which yielded 500 litres/min.

4.2.3 LOWER FRACTURED AQUIFER (FRACTURED AQUIFER, 70 TO 100 M. IN DEPTH)

Figure 4.3 shows the number of wells classified by yield. The 18 wells (7.2 %) yielded more than 100 litres/min. The bar chart shows that the range of the yield from 100 to 200 litres/min was prominent. No.M-2(2) (Bodagama) and No.M-4(2) (Yalabowa) were drilled to 100 m to confirm the productivity of this fractured zone. As a result, the pumping tests of No.M-2(2) and No.M-4(2) were conducted for 72 hours with the pumping rate of 440 and 610 litres/min respectively. No.M-3 (Badalkumbura) yielded more than 5000 litres/min during the drilling from 83 to 88 m depth.



Yield (liter/min)	Number	Accumulating Total	
		No.	%
0	74	74	29.5
0 – 10	104	178	70.9
10 – 20	26	204	81.3
20 – 30	7	211	84.1
30 – 40	3	214	85.3
40 – 50	4	218	86.9
50 – 60	7	225	89.6
60 – 70	3	228	90.8
70 – 80	4	232	92.4
80 – 90	0	232	92.4
90 – 100	1	233	92.8
100 – 200	11	244	97.2
200 – 300	3	247	98.4
300 – 400	1	248	98.8
400 – 500	0	248	98.8
500 – 800	3	251	100.0

Figure 4.3 Number of Wells Classified by Yield

(Lower Fractured Aquifer, 70 to 100 m in Depth)

4.2.4 DEEPER FRACTURED AQUIFER (FRACTURED AQUIFER, 100 TO 200 M IN DEPTH)

The productive fractures were confirmed below 100 m occurred in the test wells except No.H-1 and No.H-4. The fracture that occurred in No.H-2 (Talunna) was most productive. The pumping test had been conducted for 4 days with the pumping rate of 415 litres/min. And there was a large fractured zone from the depth of 105 to 116 m in borehole No.H-6 (Tammennawewa). However, the formation was too loose to penetrate. It is low possibility to drill the well into such loose formation.

4.2.5 INTERCONNECTION OF AQUIFERS

Each fractured aquifer described in the previous section is separated by hard rock. This hard rock zone is most likely impermeable. Even so, the existence of an interconnected fracture network between the upper fractured aquifer and the deeper fractured aquifer is indicated by the result of pumping test. The seasonal water level fluctuation also seems to show the existence of the interconnection of fractures in the basement rock.