

STUDY TO IDENTIFY ADEQUATE WATER SOURCE TO IMPROVE THE CAPACITY OF WATER SUPPLY SCHEMES IN BIBILE DIVISIONAL SECRETARIAT AREA

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Abstract: This study area covers villages belongs to the Bibile Divisional Secretariat Division (DSD) in Monaragala district closer to the western margin of Uva province. Bible's land is important to Sri Lankan agriculture. The area consists of 31 Grama Niladari Divisions which lies around the Bibile DSD. The total land area is about 30,000 ha. The objective of this study is to identify the adequacy of water supply scheme and adequate water source to improve the capacity of water supply schemes in Bibile divisional secretariat area. The primary data for this study collected by conducting interview of responsible officials from Irrigation Department, Monaragala, National Water Supply and Drainage Board (NWSDB), Monaragala, Medical officer of Health (MOH) , Bibila, Divisional Secretariat Division (DSD),Bibila, and GN's of relevant GND's in Bibila DSD areas. The available data published in Divisional Secretariat annual reports and Censes Department's reports was taken as secondary data for this study. The elevations were obtained by used Google earth software and calibrated by GPS. Based on the consideration of the elevation, cost economic and suitability of distribution with lesser operation and maintenance cost the suitable coverage area of proposed water supply scheme was selected. The Water Demand Requirement per day was estimated based on the forecasted populations for 2012 Census data for select GND's of study area. By comparing available water sources was identified. The study shows that the existing two water supply schemes cannot cater the total demand of this area. The total water demand is about 6, 534 m³ per day. The extraction of only ground water is not suitable to this water supply scheme due to limited capacities of extraction. As per this study to cater the growing needs of still un served settlers in the area, it has been proposed that the most feasible surface water sources in the vicinity is the Mallipotha reservoir and Nayakandura stream. This water sources would be the adequate water source to improve the capacity of water supply schemes in Bibile divisional secretariat area with the capacity of 6,900 m³ per day raw water. By used this identified water sources, the water supply of this study area will be increase from existing 14 % of the demand to 75 % of the water demand by the year 2040.

Keywords: Water Demand, Ground water, Surface Water, Raw Water.

1. INTRODUCTION

Water supply and sanitation are among two of the most important sectors of development (Bendahmane 1993). The people need water for various domestic purposes like drinking, cooking, sanitation, and irrigation. Besides domestic use, people also need water for other diversified livelihood including livestock, gardening, cropping, food processing, aquaculture and fisheries (Kopper et al. 2006).

The Bibile area is lie within the intermediate climatic zone where rainfall ranges from 1500 mm to 2500 mm per annum. Since most of the settlement spreading out over from valleys to highlands, scarcity of safe drinking water during the dry spells is a predominant problem for last decades. On the other hand, required development is taking place in many sectors of the area and demands proper infrastructure to fulfil their needs. Due to severe drought period continuing in every year, the people in Monaragala district have to face many difficulties in obtaining drinking water. Bibile divisional secretariat area are also among this.

The Bibile water supply schemes cannot expand due to insufficient amount of raw water currently using for these existing schemes. People's perception on water quality is the surface water sources are terrible because of the higher usage of fertilizer and pesticide. Water levels of dug wells and surface water sources are fluctuating depending on the weather conditions. Most of the shallow dug wells dry up in drought. Quantity of water that carries in the surface water sources also subjected to seasonal changes. People of the area face severe hardships during the dry season to obtain water for the drinking and domestic purpose.

1.1. OBJECTIVE

To identify the adequacy of water supply scheme and adequate water source to improve the capacity of water supply schemes in Bibile divisional secretariat area

2. METHODOLOGY

In this study both primary and secondary data were used. The primary data for this study collected by conducting interview of responsible officials from Irrigation Department, Monaragala, National Water Supply and Drainage Board (NWSDB), Monaragala, Medical officer of Health (MOH) , Bibila, Divisional Secretariat Division (DSD),Bibila, and GN's of relevant GND's in Bibila DSD areas. The available data published in Divisional Secretariat annual reports and Censes Department's reports was taken as secondary data for this study. The elevations were obtained by used Google earth software and calibrated by GPS. Based on the consideration of the elevation, cost economic and suitability of distribution with lesser operation and maintenance cost the suitable coverage area of proposed water supply scheme was selected. The Water Demand Requirement per day was estimated based on the forecasted populations for 2012 Census data for select GND's of study area.by comparing available water sources, the adequate water source to improve the capacity of water supply schemes in Bibile divisional secretariat area was identified.

3. RESULTS AND DISCUSSION

3.1 Existing Water Supply Schemes and water sources

Presently following water supply schemes exist in the proposed Bibile DSD area. There is one water supply scheme operated by NWSDB and another one operated by local authority. The current situation of these water supply schemes are described as follows.

- Bibile Small Town Water Supply Scheme
- Bibile water supply Scheme (local Authority)
- CBO(Community Based Organisations) Pipe Water Supply Schemes

3.1.1 Bibile Small Town Water Supply Scheme

Limited area of Bibile DSD is covered by the Bibile small town water supply scheme. It is consists of about 2,000 house connections operated by this scheme. Total production volume is about 850 m³/day and water is distributed daily by 24 hrs. The water is distributed by gravity. This scheme is operated with the surface water taken from Nayakandura stream. This stream is a small sub stream with a small catchment area therefore water quantity is significantly reduce in drought period. As per the records of NWSDB the maximum amount of water abstracted during normal and rainy days about 900 m³ / day and minimum amount during the drought period 150 m³ / day.

3.1.2 Bibile water supply Scheme (Operated by local Authority)

The part of Yalkumbura and Bibile GND is covered by the Water Supply Scheme operated by the Local Authority. They have given about 400 house connections from this scheme. This scheme is operated with the surface water taken from same Nayakandura stream which used by NWSDB for Bibile small town water supply scheme. The total Production volume is 200 m³ /

day and water flows daily by 24 hrs of gravity. As this stream is a small sub stream with a small catchment area water quantity is significantly reduce in drought period.

3.1.3 CBO Pipe Water Supply Schemes

There are seventeen numbers of CBO water supply schemes in this area as shown in table 1. The details were collected from rural water supply section of NWSDB, Monaragala shows that about 3732 numbers of water supply connection provided by CBO water supply schemes. The water quality of these CBO water supply schemes are not in up to the drinking water quality standards since all these schemes follows either only chlorination or no treatment.

Table 1: Details of community based water supply schemes in Bibile DSD

No	GND Name	No of Connection	RWS scheme managed by CBOs
1	Badullagammana	290	Badullagammana CBO , Badullagammana, Bibile
2	Egodakotagama	240	Egoda kotagama CBO
3	Hamapola	200	Hamapola GS
4	Hewalwela	180	Helaarawa, madawalawatta, Udawela WSS
5	Kanaweegalla	90	kanaweegolla GS
6	Karagahawela North	240	Karagahawela community WSp
7	Karagahawela west	352	Dehigalawatta WSP
8	Karandugala	90	Jathiya godanegeeme organization
9	Kotagama	275	Kotagama CBO
10	Mallehawa	205	Mallehawa CBO
11	Medapitiya	180	Medapitiya CBO, Bubulewatta, Medapitiya, Bibile
12	Muudiyala	315	Sesiri CBO, Muudiyala, Bibile
13	Pitakumbura	45	Pitakumbura CBO, Gangodaketiya, Pitakumbura, Bibile
14	Thanayamgama	55	Thanayamgama CBO, thanayamgama, Bibile
15	Udamallehawa	200	Udamallehawa CBO, Udamallehawa, Diyakomala, Bibile
17	Weegama South	150	Weegama south GS
Total		3732	

3.2 Present Water Use Practice

The details of the existing water use practice by the people in Bibile is shown in figure 1.

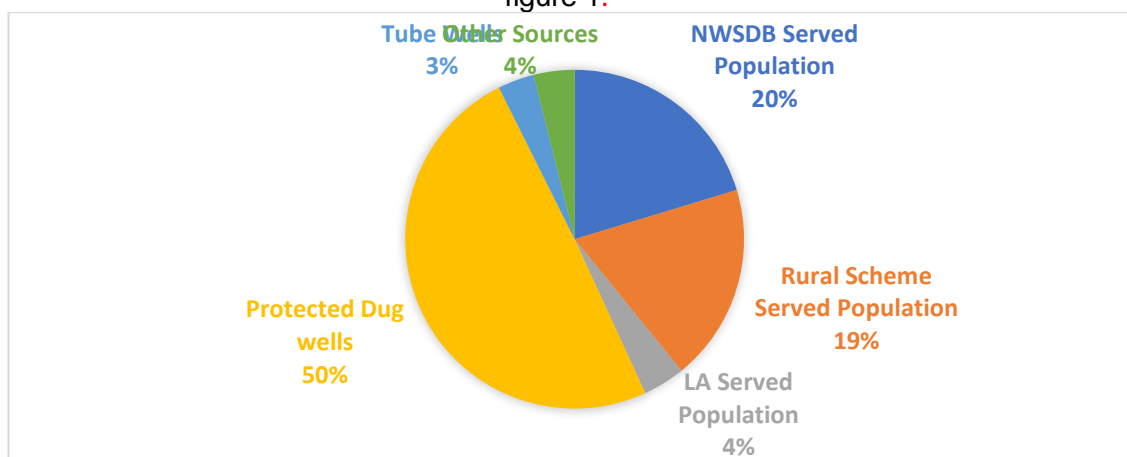


Figure 1: Details of existing water use practice

The partially treated pipe borne water supply coverage is about 18 %. Majority of the people depend on dug wells and unprotected water sources. There are no considerable treated water pipe borne water supply facilities in this study area. About 61 % of the people uses other unprotected sources.

3.3 Coverage Area of Water Supply Scheme

Based on the consideration of the elevation, cost economic and suitability of distribution with lesser operation and maintenance cost the suitable coverage area of proposed water supply scheme was selected as shown in the figure 2



Figure 1: Coverage Area of Water Supply Scheme

The substantially higher elevated location in Godagama GND (360 m MSL) was to for new ground reservoir to supply water by gravity while existing ground reservoir in Yalkumbura GND (340 m MSL) to serve existing coverage area in the proposed scheme.

3.4 Health and Sanitation Aspects

The Health aspects of the study area have been analyzed to identify the impacted due to lack Water Supply in this area. Details of health and sanitation were reflecting that number of water borne diseases are reported in this study area during last three years. The recent statistic shows that 400 out of 1000 students in the area are suffering with fluorosis due to high fluoride content of the water. However, this figure may be totally different if data from private medical centers and unreported incidents are taken into the account. The Table 2 Communicable Diseases shows the last three years in this study area.

Table 2: Communicable Diseases

Year	Diseases	Number
2017	Dysentery	12
	Viral Hepatitis	8

	Typhoid	2
	Food poison	1
2016	Dysentery	11
	Viral Hepatitis	9
	Typhoid	0
	Food poison	1
2015	Dysentery	11
	Viral Hepatitis	87
	Typhoid	1
	Food poison	0

3.5 Determination of Water Demand Requirement

The Water Demand Requirement per day was estimated based on the forecasted populations for 2012 Census data for select GND's covered by proposed water supply schemes by considering the twenty years of design periods. The Table 3 shows that the design parameters considered for estimation of water demand.

Table 3 Design parameters for water demand calculations.

Design Parameters	Value
Growth Rate	1.15
Migration Factor	0.3
Growth Rate considered for calculations	1.45
% of Domestic connections	100
% of Industrial Consumption	2
% of Commercial Consumption	10
UFW%	20
Domestic consumption (Liter per capita per day)	120

The current water demand requirement for existing population is about 5980 meter cube per day but supplied only maximum of 850 m³ partially treated water. It is about only 14 % of demand.

The water demand requirement for the proposed Bibile water supply scheme shown in the table 4.

Table 4: Summary of per day Water Demand Requirement

	2020	2030	2040
Covered Population	16,293	21,360	39,310
Water Demand in m ³	2,708	3,550	6,534

The proposed water demand by the year 2040 the water demand is a 6,534 meter cube per day. The total water demand included average industrial and commercial consumption of about 12% of the domestic demand. Considering the details collected from the existing water supply schemes and the proposed modern facilities, losses

due to unaccounted for water is assumed as 20% of the total demand. The table 5 shows the water demand requirement estimations in details for proposed scheme by considering suitable coverage area.

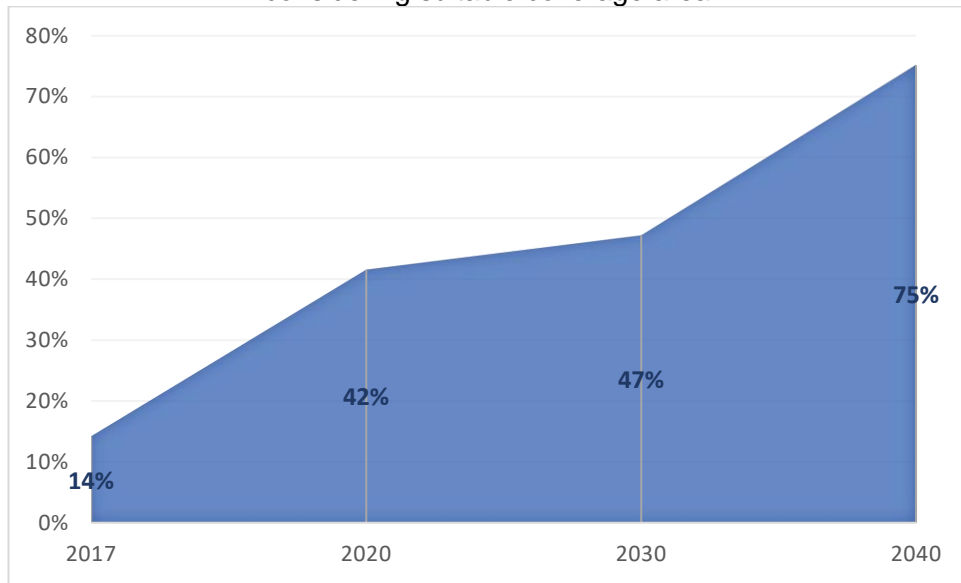


Figure 2: Water demand and supply

The figure 2 shows the existing and proposed water demand and supply percentage of this study area. The existing coverage is about 14% water demand only supply currently in the year 2017. By considering the implementations of proposed capacity improvement to be completed by the year 2020, the water supply can be improved to 42 % of the demand. Also the water supply can be achieved 75 % of demand by the year 2040.

Table 5: Estimation of Water Demand Requirement for proposed scheme

GNDs	GND No	Population 2012	Population 2017	2020				2030				2040			
				Population	Coverage Area %	Covered Population	Total Demand (m ³ /d)	Population	Coverage Area %	Covered Population	Total Demand (m ³ /d)	Population	Coverage Area %	Covered Population	Total Demand (m ³ /d)
Ambelanda	100c	812	873	951	50	476	79	1,099	60	659	110	1,269	100	1,269	211
Kanuwela	99A	2,047	2,200	2,398	50	1,199	199	2,770	60	1,662	276	3,198	100	3,198	532
Kokunnewa	101D	985	1,059	1,154	50	577	96	1,333	60	800	133	1,539	100	1,539	256
Morattamulla	101E	856	920	1,003	25	251	42	1,158	35	405	67	1,337	50	669	111
Nagala	101B	1,344	1,444	1,575	50	787	131	1,818	60	1,091	181	2,100	100	2,100	349
Radaliyadda	102A	1,159	1,245	1,358	50	679	113	1,568	60	941	156	1,811	100	1,811	301
Ambagolla	102D	989	1,063	1,159	20	232	39	1,338	20	268	44	1,545	30	464	77
Wegama	102	1,112	1,195	1,303	20	261	43	1,505	20	301	50	1,737	30	521	87
Wegama South	102C	1,376	1,479	1,612	25	403	67	1,862	30	559	93	2,150	50	1,075	179
Mallehewa	102B	1,207	1,297	1,414	50	707	118	1,633	60	980	163	1,886	100	1,886	313
Karagahawela East	96B	787	846	922	20	184	31	1,065	20	213	35	1,230	50	615	102
Karagahawela West	96A	1,008	1,083	1,181	20	236	39	1,364	20	273	45	1,575	50	787	131
Udamallehewa	102G	869	934	1,018	20	204	34	1,176	20	235	39	1,358	50	679	113
Egoda Kotagama	97A	670	720	785	40	314	52	907	40	363	60	1,047	80	837	139
Kotagama	100F	1,584	1,702	1,856	40	742	123	2,143	40	857	142	2,475	80	1,980	329
Badullagammana	100F	1,584	1,702	1,856	50	928	154	2,143	60	1,286	214	2,475	100	2,475	411
Kavudella	100D	1,036	1,113	1,214	60	728	121	1,402	70	981	163	1,619	100	1,619	269
Rathupasketiya	100B	1,572	1,689	1,842	75	1,381	230	2,127	80	1,702	283	2,456	100	2,456	408
Lindakumbura	101C	1,339	1,439	1,569	70	1,098	183	1,812	70	1,268	211	2,092	100	2,092	348
Bibila	100	1,579	1,697	1,850	50	925	154	2,136	60	1,282	213	2,467	100	2,467	410
Dodamgolla	99	1,181	1,269	1,384	85	1,176	195	1,598	85	1,358	226	1,845	100	1,845	307
Dehiattawela	99B	854	918	1,001	50	500	83	1,155	60	693	115	1,334	100	1,334	222
Ethanawatta	98A	689	740	807	50	404	67	932	60	559	93	1,077	100	1,077	179
Kuruwamba	100A	1,059	1,138	1,241	70	868	144	1,433	75	1,075	179	1,655	100	1,655	275
Yalkumbura	98	748	804	876	25	219	36	1,012	30	304	50	1,169	50	584	97
Mudiyela	98B	809	869	948	10	95	16	1,095	15	164	27	1,264	40	506	84
kanawegalla	102F	496	533	581	20	116	19	671	20	134	22	775	40	310	52
ussagala	102E	554	595	649	10	65	11	750	15	112	19	866	20	173	29
Bokagonna	101	1,409	1,514	1,651	10	165	27	1,906	15	286	48	2,202	20	440	73
Thotillaketiya	103C	829	891	971	10	97	16	1,122	15	168	28	1,295	20	259	43
Medipitiya	99C	940	1,010	1,101	25	275	46	1,272	30	382	63	1,469	40	587	98
Total		33,483	35,982	39,228		16,293	2,708	45,302		21,360	3,550	52,316		39,310	6,534

3.6 Water Source Alternatives for water supply scheme

The both surface water and ground water sources were considered to fulfil the required water demand of proposed water supply scheme.

3.6.1 Surface Water Sources

The present water supply schemes in Bibile is fed by Nayakandura Stream. Other suitable surface water source for the water supply scheme is newly constructed Mallipotha reservoir. The details of water sources are as follows.

- Nayakandura stream is a stream of average rate flow of 900 m³ per day with small catchment area therefore water quantity is significantly reduce during the drought period.
- Mallipotha reservoir is owned and maintained by Irrigation department. It is newly constructed reservoir with the water capacity of 750 Ac ft. to feed about 200 Ac of paddy fields. As per the information given by Director of Irrigation, Monaragala, It can be approved to provide the maximum of 6,000 m³/day of water to drinking water supply requirement.

3.5.2 Ground Water Sources

According to the analysis of existing tube well data collected from ground water section of NWSDB, Monaragala, as shown in the Table 6, there are no ground water sources sufficient enough to cater the required water demand. Also as per the water quality report of NWSDB, the ground water sources contained heavy iron in the raw water.

Table6. Tube Well Details – Bibile Divisional Secretary Area

Village	Location	Date	Total depth (m)	Final Yield (lpm)
Wegama-south	Community center	21-02-12	37	500
Ilukpitiya short cut	Premises of Mrs. Suplishami	20-07-12	25	1000
Wegama	Bibilawatta	10-05-00	40.5	1200
Rathupaskatiya	Rathupaskatiya	7-09-00	43.5	750
Bibile	Kotagama road	15-09-00	61	750
Bibile	Monaragala road 1 st m.p	9-06-87	36	300
Bibile	Badulla road	17-06-87	36	200
Bibile	Badulla road 3 rd M.p	19-06-87	36	200

4. CONCLUSIONS

The study shows that the existing two water supply schemes cannot cater the total demand of this area as the limited capacities of the schemes and lack of raw water.

Thus people in the suburbs of the area face severe difficulties in satisfying their drinking water requirement. The total water demand which 6, 534 m³ per day. All of these schemes operate in partial treatment hence water quality level of the schemes not up to standards. The extraction of only ground water is not suitable to this water supply scheme due to limited capacities of extraction. As per this study to cater the growing needs of still un served settlers in the area, it has been proposed that the most feasible surface water sources in the vicinity is the Mallipotha reservoir and Nayakandura stream. This water sources would be the adequate water source to improve the capacity of water supply schemes in Bibile divisional secretariat area. By combining both water sources 6,900 m³ per day raw water can be abstracted for drinking water supply. By used this identified water sources, the water supply of this

study area will be increase from existing 14 % of the demand to 75 % of the water demand by the year 2040.

5. REFERENCES

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