CHAPTER – 3

IRRIGATION PRACTICES IN JALPAIGURI DISTRICT

3.1 Introduction

Irrigation in India includes a network of major and minor canals from Indian Rivers; groundwater well based systems, tanks, and other rain water harvesting projects for agricultural activities and of these, groundwater system is the largest (Siebert, et al, 2010). In the context of India, the earliest mention about Irrigation was found in "Rigveda". But here only well type irrigation has been mentioned. Later, the 4th-century BCE Indian scholar Paṇini, mentions tapping several rivers for irrigation (Puri, 1968). After independence India's irrigation covered crop area was about 22.6 million hectares in 1951, and it increased to a potential of 90 million hectares at the end of 1995, inclusive of canals and groundwater wells. The total arable land in India is 160 million hectares (395 million acres). According to the World Bank, only about 35% of total agricultural land in India was reliably irrigated in 2010. The ultimate sustainable irrigation potential of India has been estimated in a 1991 United Nations' FAO report to be 139.5 million hectares, comprising 58.5 million hectares from major and medium river-fed irrigation canal schemes, 15 million hectares from minor irrigation canal schemes, and 66 million hectares from groundwater well fed irrigation. In West Bengal, the irrigation system was started since pre-colonial rule. During the rainy season, excess water was redistributed through artificial channels during this period. The first Indian Irrigation Commission on Agriculture was set up in 1901-03 and The Royal Commission on Agriculture was set up in 1928. But the role of irrigation in West Bengal was identified in 1947 after the independence of India. The importance of irrigation stressed upon during the 1960s with the introduction of New Agricultural Strategy (NAS). In 1987, the Irrigation and Waterways Department of Government of West Bengal has taken an attempt to prepare an assessment of the available water resource in West Bengal state. "The expert committee explored in detail on the 26river basin of West Bengal stated that through the surface water in West Bengal is estimated to be 13.29 million hectares, only about 40 per cent of it is usable, while the available groundwater through being 1.46 million hectares only is totally useable" (Rudra, 2009).In the context of Jalpaiguri District, the farmers have used groundwater as a main source of irrigation before the various canals came into existence. The water for irrigation has been taken from various

sources like shallow Tube well, Tube well, Deep Tube well, Pond and Dug well etc. But since the construction of Teesta barrage projects started (1974-76), the method of irrigation changes dramatically. Especially blocks like Rajganj and Jalpaiguri, where the main canals of Teesta and other rivers have been constructed. From the primary survey the Researcher found that, presently the farmers have used more than one sources of irrigation or maybe called as combination of sources of irrigation. But the ancestor or previous generation of the farmers had used ground water or the water source like ponds, due to absence of canals. In the blocks like Nagrakata, Mal and Matiali, they (farmers) were also used the water of 'Jhoras canals' for the purpose of crop cultivation. As the irrigation system was not well developed, most of the time the success of the cultivation depends on Monsoon. In the past due to irregularity in monsoon and less developed irrigation system, the production of crops especially in the non-monsoonal periods have been affected and consequently the productivity of the various crops has been decreased. The researcher has collected information since 1997, and it can be found that from last two decades the canal irrigation has been developed well in all over the district. The farmers have now using surface irrigation water more frequently; as a result, the production of non-monsoonal crops has been increased.

Water is an essential element for plants growth as it is transport important nutrients from the soil to the various parts of the plant. Modern seeds and fertilizers fail to achieve their full potentiality in the absence of optimal quantity of water. Growing population and demand of food grains, leads to the implementation of High Yielding Variety seeds in the agricultural activities, and thus for the cultivation of HYV crops there is need of optimal water supply. The irrigation infrastructure of the country includes a network of canals from rivers, ground water, well based systems, tanks and other rain water harvesting products for agriculture activities. The Groundwater system is the largest covering 39 million hectares of cultivated land irrigated by ground water and 22 million hectares by irrigated canals and about two third of cultivation in India is still depending on monsoon. The study area has also similar scenario in respect to irrigation cover. Nearly 140741 hectares of land is under the Net sown area and 72129 hectares of land under irrigation, which is about 51% of the former. Both the Ground Water and Surface water irrigation system have found here. Blocks like Rajganj, Jalpaiguri Sadar, Mynaguri and Mal have covered with Canal irrigation and the other blocks of the district i.e. Nagrakata, Dhupguri and Matiali, the farmers rely on Ground water for irrigation. In this chapter the

researcher has presented Spatio-temporal changes of various irrigation methods in the district from 1997 to 2018 to understand the status of irrigation in Jalpaiguri District.

The blocks like Rajganj, Jalpaiguri Sadar, Mynaguri, Dhupguri has well define irrigation system, where it is found that nearly 30% of the total geographical area of these block under irrigation. More specifically Rajganj has 29.58%, Jalpaiguri Sadar has 32.79%, Dhupguri has 26.85% and Mynaguri has 24.44% of area under irrigation in respect to total geographical area. On the other hand, blocks like Matiali, Nagrakata, and Mal have not well developed irrigation system. Table 4.1 has mentioned the block-wise existing and requires water for agriculture purpose. And the table (table: 4.1) depicted that the Raiganj (0.45310 BCM), Jalpaiguri Sadar (0.511122 BCM), Mynaguri (0.55300 BCM) and Dhupguri (0.46102 BCM) block has needed much greater quantity of water than the rest of the block for agriculture.

Table 3.1 Block-level Existing water potentiality and Demand of Jalpaiguri District.

Blocks	**TGA (ha)**	**Irrigated Area (ha)**	**Percentage of Area Under Irrigation**	**Crop Water Demand (BCM)**	**Existing Water potential (BCM)**	**Water Potential to be created (BCM)**
Rajganj	61483	18186	29.58	0.45310	0.18186	0.27124
Jalpaiguri Sadar	50065	16415	32.79	0.51122	0.16415	0.34707
Mynaguri	53060	12970	24.44	0.55300	0.12970	0.42330
Dhupguri	55055	14780	26.85	0.46102	0.14780	0.31322
Malbazar	54590	7424	13.60	0.28550	0.07424	0.21126
Matiali	20491	1572	7.67	0.05500	0.01572	0.03928
Nagrakata	39749	782	1.97	0.07137	0.00782	0.06355
District Total	**334493**	**72129**	**21.56**	**2.39021**	**0.72129**	**1.66892**

Source: CWC, Dept. of Water resources in district & status report, 2017-18

But the present scenario of water availability in the blocks is very much less than the requirement. Rajganj block has only 0.18186 BCM of water available and it needs more 0.27124 BCM of water not fulfill the gap. Similar scenario has been found in the other blocks of the district. Especially Jalpaiguri Sadar, Mynaguri and Dhupguri block has needed more than two times of water in respect to existing water.

3.2 Utilization of Ground water for Irrigation of Jalpaiguri District

The water which penetrates through the rocks and crust and stored below the surface or in an impermeable layer is called Ground Water. Man has been drawing this precious natural resource from his existence on earth for developmental activities, in the fields of agriculture, industries

and for his domestic usage. The main source of Earth's liquid freshwater is Groundwater, which is stored in aquifers. Nearly 92% of ground water utilizes for irrigation purpose, five and three per cent respectively for industrial and domestic sector (Khurana and Sen, 2008). Ground water has a very important bearing on the growth of plants. The entire water incident on the surface by rainfall or the water that is applied by the artificial means cannot be retained by the soil. A part of the water is lost in the form of evaporation and a part as surface flow. Therefore, the water that seeps into ground is total water minus losses. (Chandrasekhara, 1965). Groundwater has rapidly emerged to occupy a dominant place in India's agriculture and food security in recent years (Gandhi, et al, 2011). From the last three decades the growth of irrigation has enormously increased, especially in Groundwater irrigation, where it is found that nearly 60% of the irrigated area of the country covers with Groundwater irrigation. Since the growth in groundwater irrigation has not been largely government or policy driven and has happened mainly through highly decentralized private activity, the groundwater revolution has gone by and large unnoticed.

Table 3.2 Dynamic groundwater resource of India, 2004

Sl. No.	Categories	Water in BCM
1.	Total Replenishable groundwater Resources	433.02
2.	Provision for domestic, Industrial and other Uses	29.17
3.	Available Groundwater resources for irrigation in net terms	403.85
4.	(3) as per cent of (1)	93.26
5.	Utilizable groundwater resources for irrigation in net terms	381.16
6.	Gross draft estimated on prorate basis	230.62
7.	Net draft	212.51
8.	Balance groundwater resources for future use in net terms	162.29
9.	Level of groundwater development	58%

Source: Central Ground Water Board, 2006

It is estimated that in India the Groundwater resource is 433.02 Billion Cubic Meter (Table 4.4) per year. The groundwater available for irrigation is estimated to be about 93 per cent of this or 403.85 BCM (after allowing about 7 per cent for domestic, industrial, and other uses), Out of this the utilizable groundwater resource for irrigation is 381.16 BCM, or 88 per cent. The annual net draft is estimated to be about 212.51 BCM so far. Thus, groundwater development is about 58 per cent of the potential in the aggregate, which may not appear so alarming.

In the study area the pattern of use of Groundwater for irrigation has also follow the national pattern, where it has found the decentralized and unnoticed growth in Groundwater irrigation. Almost half of the irrigated land of the district has been covered under the Groundwater irrigation. Especially in Dhupguri and Mynaguri blocks where the people mainly belongs to agrarian society, the proportion of agricultural land to total land is much higher and more than two-third of the irrigated land is covered with Groundwater irrigation. These blocks where the Canal irrigation still not well developed, they (farmers) largely depend on Groundwater for Irrigation. Contrary the blocks like Rajganj and Jalpaiguri Sadar has been benefited through the Canal irrigation. Thus the farmers shifted the irrigation system from Groundwater to Canal.

Table 3.3 Spatio-temporal changes in area covered by Ground water Irrigation in Jalpaiguri District.

Years	Area in '000 Hectares					
	Tank Irrigation	**Deep Tube Well**	**Shallow Tube Well**	**Open Dug Well**	**Others**	**Total**
1997-98	1.2	0.37	1.65	0.55	1.55	5.32
1998-99	1.4	0.84	1.65	0.55	6.5	10.94
1999-00	1.4	0.84	1.65	0.54	6.5	10.93
2000-01	1.1	2.2	2.12	0.54	6.8	12.76
2001-02	1.42	1.94	2.18	0.54	8.8	14.88
2002-03	1.42	1.77	2.59	2.12	8.59	16.49
2003-04	1.42	1.77	2.59	2.12	8.59	16.49
2004-05	1.26	1.64	2.81	2.12	8.59	16.42
2005-06	1.29	1.93	2.95	1.79	7.48	15.44
2006-07	1.25	1.38	6.04	2.03	7.43	18.13
2007-08	1.25	0.9	7.57	2.03	7.14	18.89
2008-09	1.25	1.36	7.96	2.58	7.14	20.29
2009-10	1.25	1.41	11.52	1.55	1.78	17.51
2010-11	1.25	1.52	13.49	0.81	1.56	18.63
2011-12	1.25	1.54	16.04	0.66	1.22	20.71
2012-13	1.24	1.54	16.16	0.6	1.12	20.66
2013-14	1.25	1.58	20.66	0.48	0.8	24.77
2014-15	1.26	1.82	22.16	0.48	0.74	26.46
2015-16	1.26	1.84	22.76	0.34	0.88	27.08
2016-17	1.26	1.76	30.34	0.27	0.64	34.27
2017-18	1.26	1.88	30.35	0.33	0.68	34.5

Source: District Statistical Handbook, 1997-2018

Table 3.3 depicts the temporal changes of area covered by different sources of ground water irrigation. The researcher has taken ground water data from 1997 to 2018 to show the changing status of ground water irrigation in Jalpaiguri district. The data given in the table has depicted

that the sources of groundwater irrigation have been divide into five categories. These are Tanks, DTW, STW, ODW and others.

3.2.1 Tank Irrigation

The tank irrigation is an old method of ground water irrigation. Tank irrigation consists of water storage which has been introduced by constructing a small bund of earth or other materials. The tank is varying in depth and size. Though the tank irrigation had done in small scale, but it can't be ignored. The table 3.3 and figure 3.1 shows the temporal changes in area covered by Tank irrigation system by 1997 to 2018. In 1997-98 the area covered by tank irrigation in the district was 1200 hectares. In the next 2 years the tank irrigation was increased from 1200 hectares to 1400 hectares. But in 2000-01 area covered by tank irrigation was reduced to 1100 hectares. After that it was again increased to 1420 hectares since 2003-04. But after 2003-04 the area covered by tank irrigation was again decreasing and in 2017-18 the area under tank irrigation was only 1260 hectares. The trend line in the figure 3.1 has shown decline trend from 1997 to 2018, which denotes that the area under tank irrigation in the district is reducing in the last two decades.

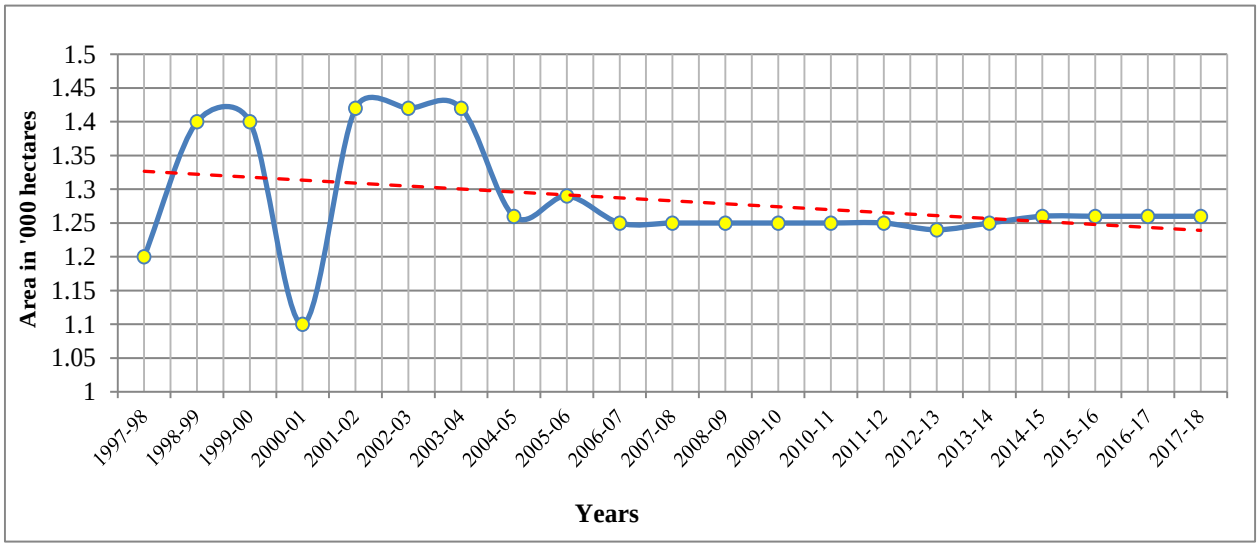
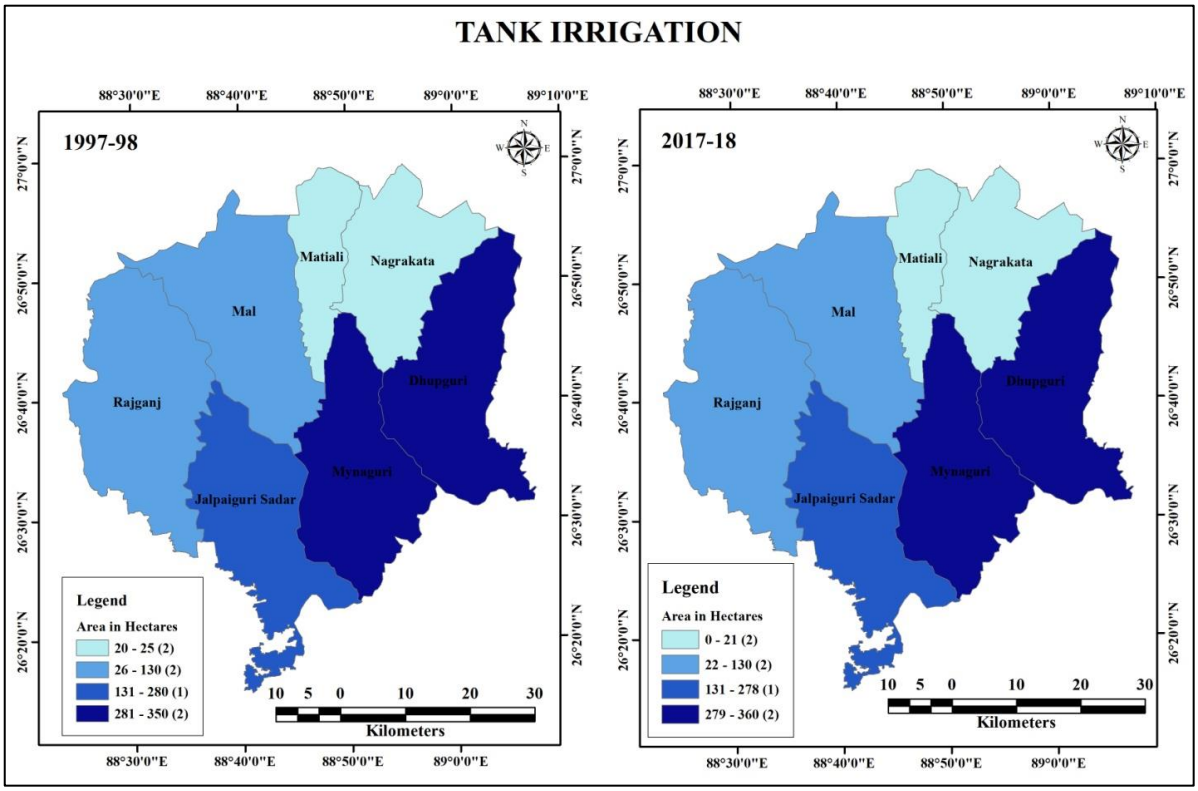


Figure 3.1 Temporal changes in area covered by Tank irrigation in Jalpaiguri District.

Source: District Statistical Handbook, 1997-2018

Table 3.4 and maps 3.1 is showing the block level area covered by Tank irrigation in two different time period i.e., 1997-98 and 2017-18 to shows the block level changes in area covered by tank irrigation in Jalpaiguri district. In 1997-98, the area covered by tank irrigation was highest in Mynaguri block i.e., 350 hectares. Dhupguri block stand 2nd in respect to area under tank irrigation, which is 320 hectares. Followings are Jalpaiguri Sadar with 280 hectares, Rajganj 130 hectares, Mal 120 hectares, Matiali 25 hectares and Nagrakata 20 hectares. In 2017-18 Mynaguri block was again highest in respect to area covered by Tank irrigation with 360 hectares. The area under tank irrigation was increased to 10 hectares in Mynaguri block from 1997 to 2018. Again Dhupguri stand 2nd in respect to area covered by tank irrigation with 320 hectares. In the last Twenty year the covered by tank irrigation was same in Dhupguri block. Similar scenario has been found in Jalpaiguri Sadar, Rajganj, Nagrakata and Mal block. But in Matiali block the area under tank irrigation was missing in 2017-18, which denotes that the farmers of Matiali block did not use Tank irrigation in recent time.



Map 3.1 Block level utilization of Tank Irrigation in Jalpaiguri District.
Source: District Statistical Handbook, 1997-2018
Prepared by the Researcher.

3.2.2 Deep Tube Well Irrigation

The Deep Tube Wells or DTWs are wells of high capacity tapping more than one aquifer. The depth of DTW usually ranges from 60 to 300 meters. The construction of DTW depends on the depth of the ground water table. These tube wells are constructed where the water table is more than 7 meters below the ground level. These are capable of discharging 200 cubic meters per hour to irrigate and cultivable command area of 40 hectares through underground pipe lines emanating from an elevated distribution chamber. A large number of such structures are existing and are being operated by Govt. machinery. However as per policy of the State these types of structures are being handed over to the users for subsequent operation, management & maintenance. The table 3.3 and figure 3.2 shows the temporal changes in area covered by Tank irrigation system by 1997 to 2018. In 1997-98 the area covered by Deep Tube Wells irrigation was only 370 hectares. The area covered by DTW irrigation was less than one thousand hectares till 1999-2000 time periods. After that in 2000-01 the area under DTW irrigation has increased more than two times, and it was 2200 hectares. Next six years i.e., from 2001 to 2007 the DTW irrigation methods covered more or less same portion area. Again in 2007-08 the area covered by DTW irrigation has fallen drastically and reached below one thousand hectares. After that an increasing trend have been observed (figure 3.2) from 2008-09 to 2017-18 in respect to area covered by DTW irrigation, where in 2008-09 it was 1360 hectares and it increased continuously over the years and in 2017-18 it was reached to 1880 hectares area under DTW irrigation.

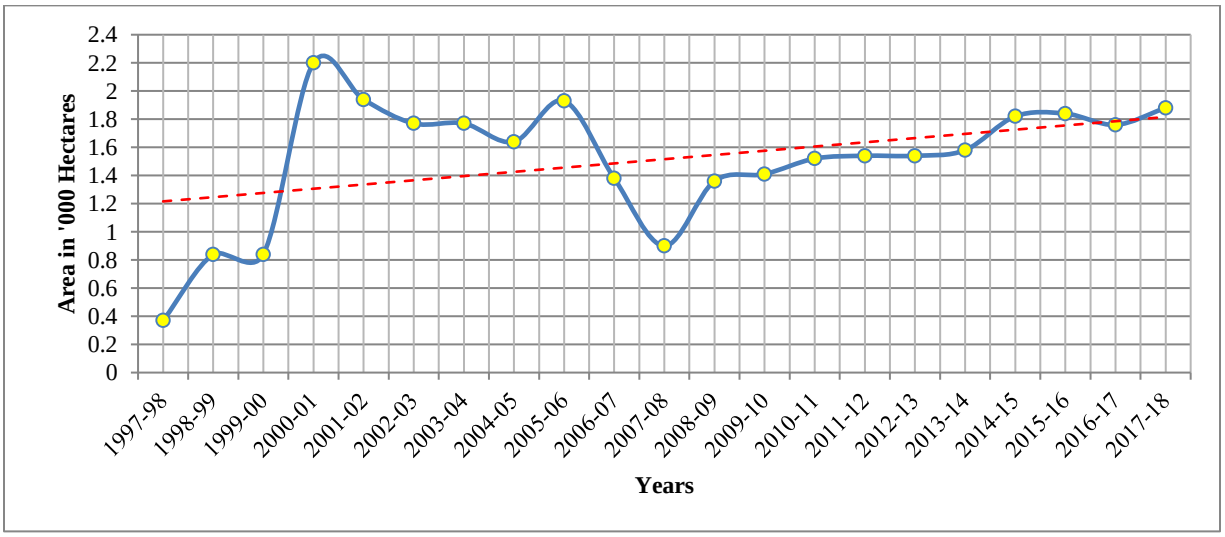
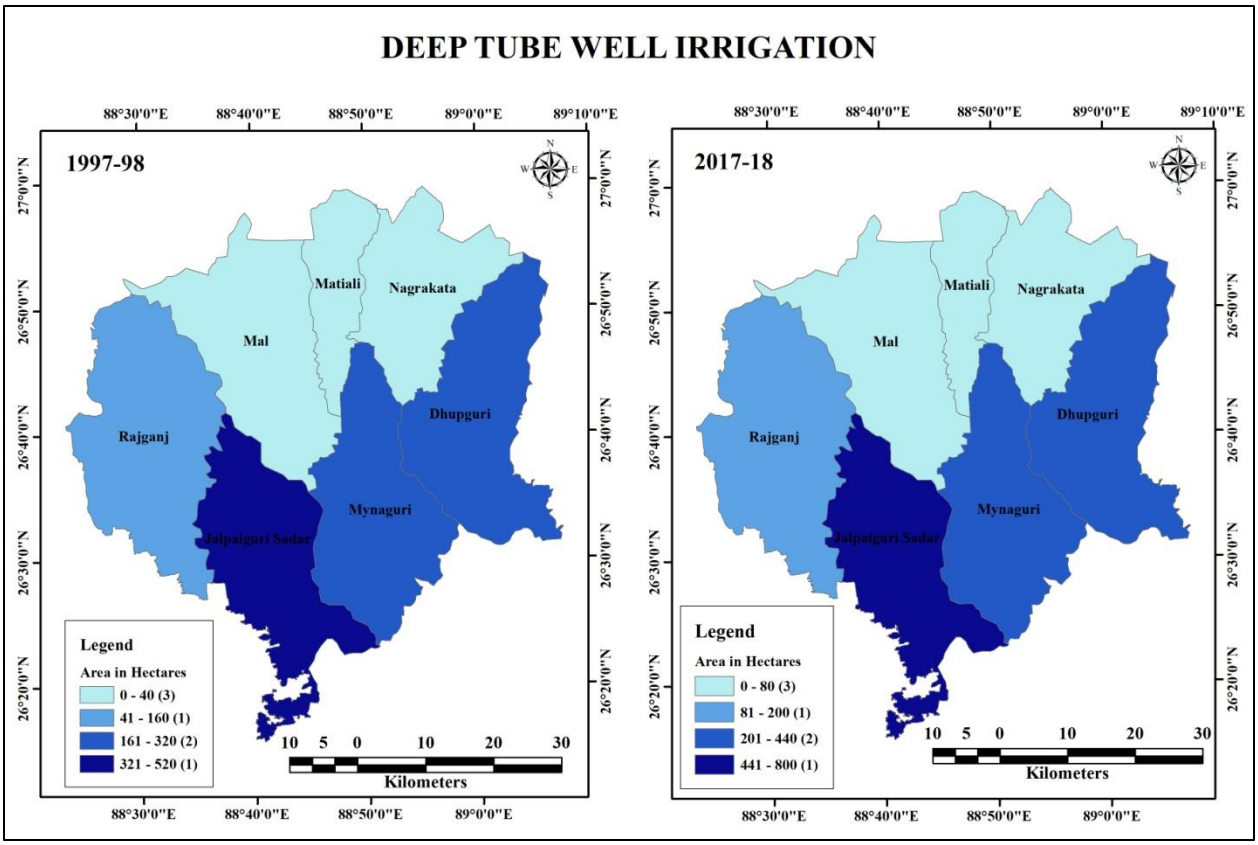


Figure 3.2 Temporal changes in area covered by DTW Irrigation in Jalpaiguri District.

Source: District Statistical Handbook, 1997-2018

Table 3.4 and map 3.2 are depicting the block level changes in area covered by DTW irrigation in two distinct time periods i.e., 1997-98 and 2017-18. In 1997-98 the area under DTW irrigation was highest in Jalpaiguri Sadar block with520 hectares of cultivable lands under this irrigation method.

Map 3.2 Block level utilization of DTW Irrigation in Jalpaiguri District.



Source: District Statistical Handbook, 1997-2018

Prepared by the Researcher.

Mynaguri and Dhupguri both blocks stands 2nd in respect to area covered by DTW irrigation, where both the blocks have 320 hectares of cultivable land under DTW irrigation. Followings are Rajganj 320 hectares, Mal 40 hectares. Rest two blocks i.e., Matiali and Nagrakata did not have any cultivable area under this irrigation method. There has been a positive changes occurred for all blocks in respect to area covered by DTW irrigation from 1997-98 to 2017-18. In 2017-18 highest area under DTW irrigation was observed in Jalpaiguri Sadar block with 800 hectares of land under this irrigation. Nearly 280 hectares of cultivable lands have been increased from 1997-98 to 2017-18 in Jalpaiguri Sadar block. Mynaguri stands 2nd with 440 hectares of cultivable land under DTW irrigation in 2017-18, where 120 hectares of land have been

increased. Following blocks are Dhupguri 360 hectares and Mal 80 hectares. Again in Matiali and Nagrakata blocks did not have any area under DTW irrigation.

Table 3.4 Block level utilization of ground water in Jalpaiguri District.

Name of the Blocks	Area in Hectares							
	1997-98				2017-18			
	Tank	Shallow Tube Well	DTW	Others	Tank	Shallow Tube Well	DTW	Others
Rajganj	130	320	160	1200	130	585	200	40
Jalpaiguri Sadar	280	2036	520	1300	278	5450	800	160
Mynaguri	350	2148	320	1775	360	4275	440	200
Dhupguri	320	2244	320	1610	320	6925	360	200
Mal	120	824	40	570	116	3390	80	0
Matiali	25	0	0	480	0	0	0	80
Nagrakata	20	0	0	500	21	35	0	0

Source: District Statistical Handbook, 1997-2018

3.2.3 Shallow Tube Well Irrigation

The Shallow Tube Well irrigation is a well-known method of ground water irrigation and it has been commonly used worldwide. A shallow tube well irrigation system is a procedure in which a long pipe sunk into the ground intercepting and water is lifted with the help of a pumping set operated by an electric motor, diesel or solar engine. A shallow tube well generally 30 m deep and the diameter of the tube well are range from 80mm to 600mm. “West Bengal accounts for nearly 10 per cent of total STW in West Bengal which is next to U.P, Punjab & Bihar despite the high growth in STW irrigation in the state (4.35 per cent per annum during 1987-88 to 1995-96)” (Singh and Dhillon, 2006). Table 3.3 and figure 3.3 are depicting the Spatio-temporal changes in area covered by Shallow Tube Well irrigation from 1997 to 2018. In 1997-98 the area covered by STW irrigation was only 1650 hectares and till 1999-2000 the area was same. In 2001-02 the cultivable area was increased to 2120 hectares. The cultivable area was below 3000 hectares till 2005-06. After that in 2006-07 it was increased more than twice with 6040 hectares. After 2006-07, rapid changes have been occurred over the years and in 2017-18 the area under STW irrigation was reached to 30350 hectares. The STW irrigation has been increased more than 18 times from 1997 to 2018. Theses reveal that the dependency on ground water irrigation has been increased in STW irrigation among the farmers of the district in last two decades.

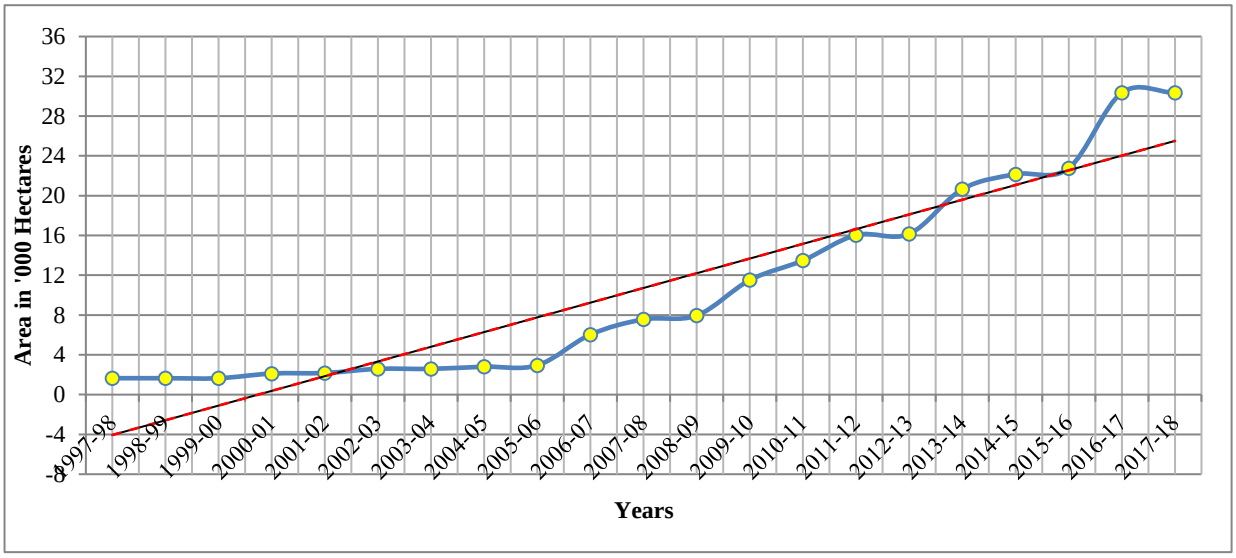
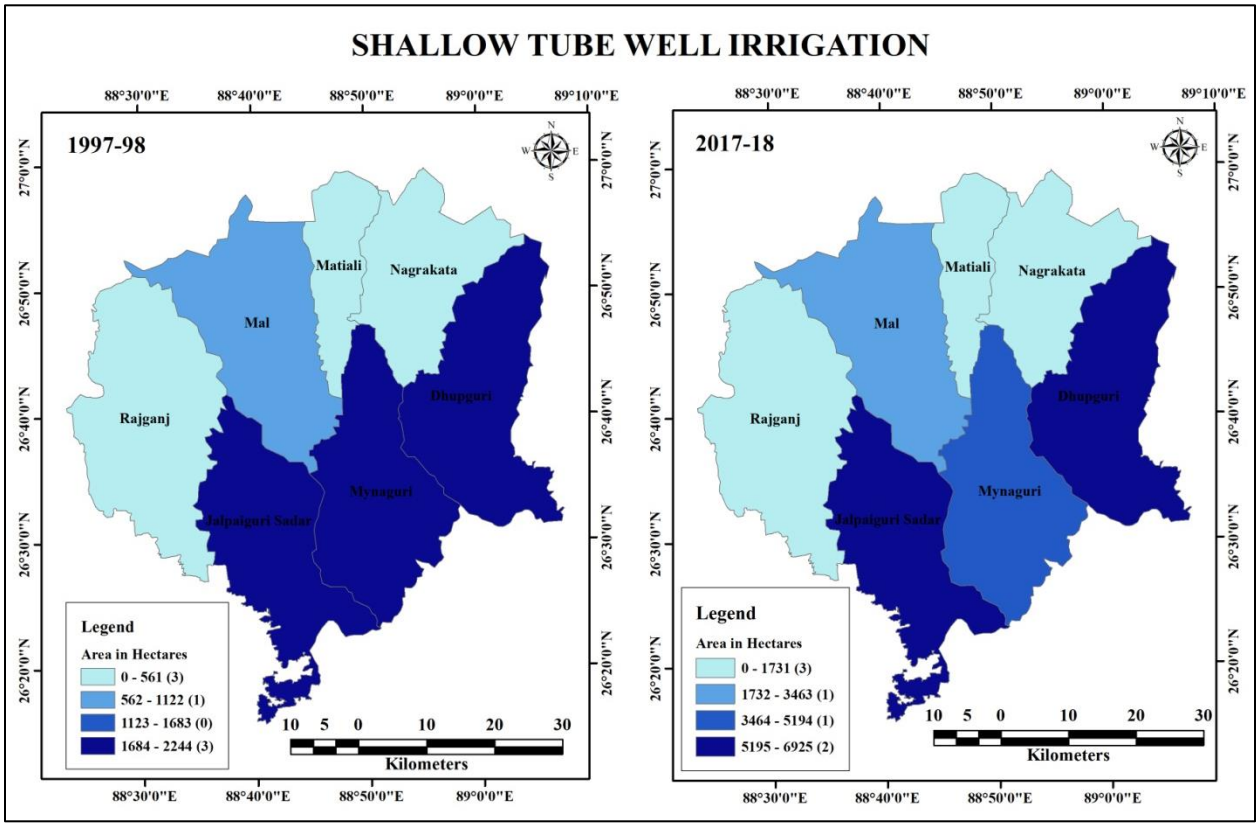


Figure 3.3 Spatio-temporal changes of area covered by STW irrigation in Jalpaiguri District.

Source: District Statistical Handbook, 1997-2018

Table 3.4 and map 3.3 are showing block level changes in area under STW irrigation in Jalpaiguri district for two distinct time periods i.e., 1997-98 and 2017-18. In 1997-98 the highest STW irrigation was occurred in Dhupguri block with 2244 hectares of cultivable lands under this irrigation method. Mynaguri stands 2nd in respect to area covered by STW irrigation with 2148 hectares of cultivable lands. Jalpaiguri Sadar block has also more two thousands of cultivable land under this irrigation technique. Following other block are mal 824 hectares, Rajganj 320 hectares. Rest two blocks i.e., Matiali and Nagrakata did not have any area under STW irrigation. In case of 2017-18 again Dhupguri has the highest area covered by STW irrigation with 6925 hectares of cultivable lands. The area was increased more than two times in Dhupguri block over the last two decades. Jalpaiguri Sadar stands 2nd in respect to area covered by STW irrigation in 2017-18. In this year Jalpaiguri Sadar has 5450 hectares of land under this irrigation method. More than 3000 hectares of lands have been increased in Jalpaiguri Sadar block over the last two decades. All the blocks (except Matiali) have increased the area under STW irrigation in the same time span. The other blocks are Mynaguri 4275 hectares, mal 3390 hectares, Rajganj 585 hectares and Nagrakata 35 hectares. Only in Matiali block no area has been found under STW irrigation till 2017-18. The overall analysis on STW irrigation in Jalpaiguri District denotes that the reliability of ground water irrigation has shifted from other types of ground water irrigation

towards shallow tube well irrigation due to easy and cost efficient maintenance and installation of STW irrigation in the cultivable field.



Map 3.3 Block level utilization of STW Irrigation in Jalpaiguri District.

Source: District Statistical Handbook, 1997-2018
Prepared by the Researcher.

3.2.4 Open Dug Well Irrigation

The Open Dug Well is also a ground water irrigation method, where the water was extract from ground through Dug Wells. Dug well is a hole, usually vertical, excavated in the surface of the earth for collecting groundwater to the surface. The diameter of the dug wells generally varies from 1 meter to 10 meters. The depths of open wells may generally range from 2 meters to 20 meters. The table 3.3 and figure 3.4 shows the Spatio-temporal changes in area covered by Open Dug Well irrigation system by 1997 to 2018. ODW irrigation system is not a popular type of irrigation method in the district. In 1997-98 the area under ODW irrigation was only 550 hectares in the whole district. The same scenario was continued until the year 2002-30 when the area covered by it crossed 2000 hectares. In 2002-03 the cultivable area under ODW irrigation

was 2120 hectares and more or less scenario has been observed till 2008-09. After that a sharp declining trend has been observed in respect to area covered by ODW irrigation. In 2017-18 only 330 hectares of cultivable lands have been covered by this irrigation method in the entire district.

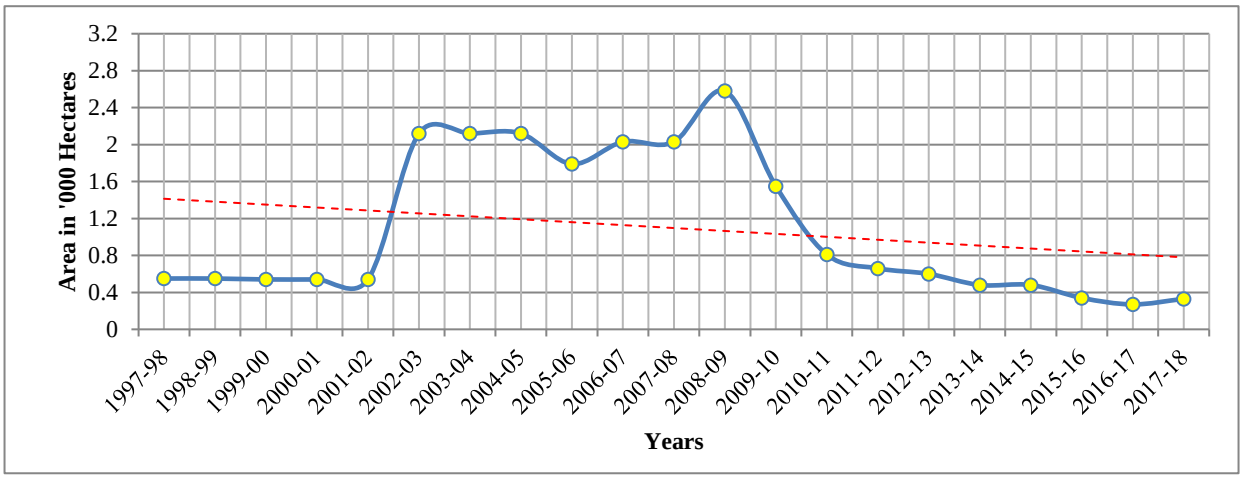


Figure 3.4 Spatio-temporal changes of area covered by ODW irrigation in Jalpaiguri District.

Source: District Statistical Handbook, 1997-2018

3.2.5 Others Sources of Ground Water Irrigation

Except the above listed sources for ground water irrigation, there have been other sources of ground water irrigation also found in the district.

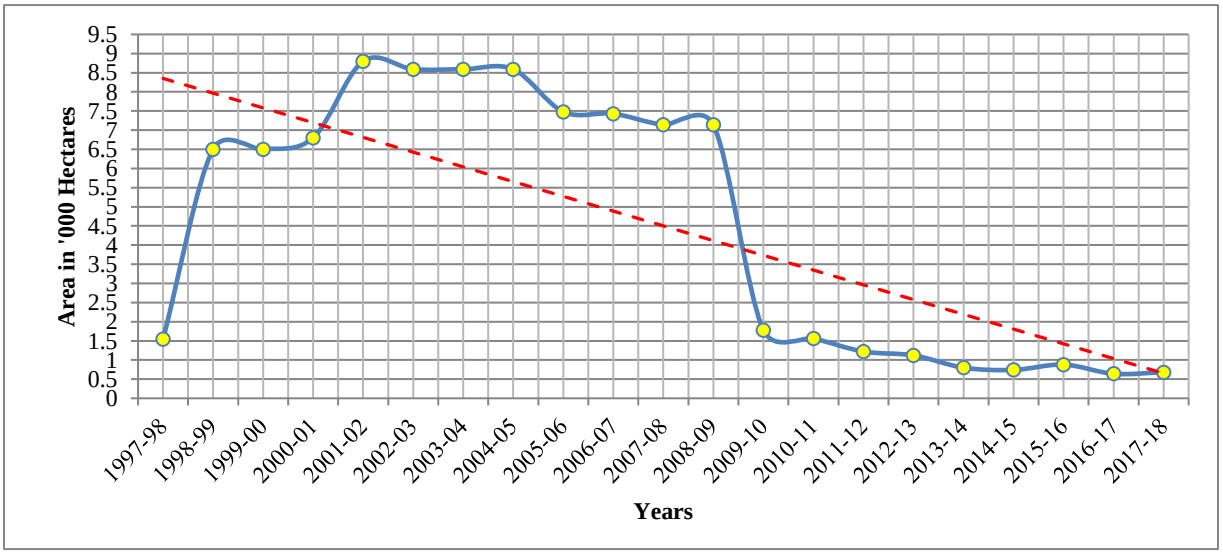
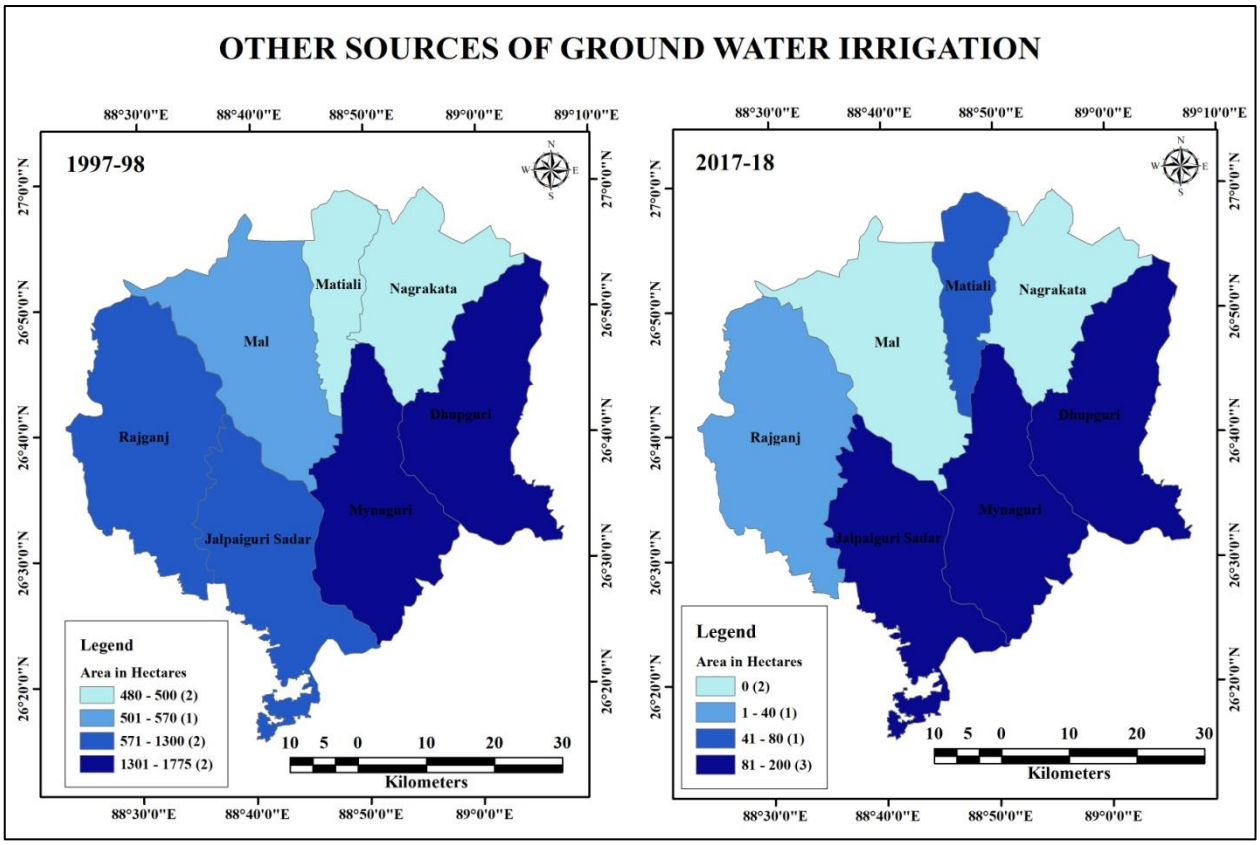


Figure 3.5 Spatio-temporal changes of area covered by Others Sources of ground water irrigation in Jalpaiguri District.

Source: District Statistical Handbook, 1997-2018

Table 3.3 and figure 3.5 are showing the Spatio-temporal changes in area covered by others sources of ground water irrigation from 1997 to 2018. In 1997-98 the area under others sources of ground water irrigation was only 1550 hectares of cultivable land. But from the next year i.e., 1998-99 a rapid increased has been observed and the area under this ground water irrigation was reached to 6500 hectares. An increasing trend was continued till 2004-05 when it reached to 8590 hectares of cultivable lands. After that a small declining trend was observed till 2008-09, when it went down to 7140 hectares. After 2008-09 a rapid declining has been observed and in 2017-18 the area under other sources of ground water irrigation was only 680 hectares of cultivable lands.



Map 3.4 Block level utilization of Other Sources of ground water Irrigation in Jalpaiguri District.

Source: District Statistical Handbook, 1997-2018

Prepared by the Researcher.

Table 3.4 and map 3.4 are showing block level changes in area under others ground water sources irrigation in Jalpaiguri district for two distinct time periods i.e., 1997-98 and 2017-18. In 1997-98 the highest area covered by other sources of ground water irrigation was found in

Mynaguri block, where 1775 hectares of cultivable land was under this irrigation. Dhupguri was in 2nd in respect to area covered by this with 1610 hectares of land under other sources of ground water irrigation. Following were Jalpaiguri Sadar with 1300 hectares, Rajganj 1200 hectares, Mal 570 hectares, Nagrakata 500 Hectares and Matiali with 480 hectares. In 2017-18, rapid reduction was observed in all blocks of the district in respect to area covered by other sources of ground water irrigation. Mynaguri and Dhupguri both reduced to 200 hectares and stand highest in the district in 2017-18. Followings are Jalpaiguri Sadar with 160 hectares, Matiali 80 hectares, Rajganj with 40 hectares. Even two block of the district namely Mal and Nagrakata did not have any area covered by other sources of ground water irrigation in 2017-18.

Table 3.5 shows the past block level numbers of different sources of ground water irrigation. In 1997-98 tanks had very few in numbers. Mynaguri block had the highest number tanks, i.e. 3. The following were 2 in Dhupguri and Jalpaiguri Sadar, 1 each in rest of the blocks. In the case of STW (Shallow Tube Well), Dhupguri had the highest number, i.e. 319 and the following were – 310 in Mynaguri, 176 in Jalpaiguri Sadar, 133 in Mal and 61 in Rajganj. The rest two blocks i.e. Matiali and Nagrakata did not have any STWs in 1997-98. The Deep Tube Well had also very few in numbers in 1997-98. The highest number was found in Jalpaiguri Sadar block i.e. 20. After that DTW was found 10 in Mynaguri, 8 in Dhupguri, 5 in Rajganj and 1 in Mal. Again the two blocks i.e. Matiali and Nagrakata did not have any DTWs in 1997-98. In case of other sources again Mynaguri had the highest number i.e. 2484 and the following were – 2379 in Jalpaiguri, 2298 in Dhupguri, 1103 in Rajganj, 650 in Mal, 150 in Matiali and 55 in Nagrakata.

Table 3.5 Block-level Numbers of Different Source of Ground Water Irrigation in Jalpaiguri District.

Name of the Blocks	Number of Particulars							
	1997-98				2017-18			
	Tank	Shallow Tube Well	DTW	Others	Tank	Shallow Tube Well	DTW	Others
Rajganj	1	61	5	275	1	117	5	1
Jalpaiguri Sadar	2	176	20	1905	2	1505	20	4
Mynaguri	3	310	10	1870	3	1161	11	5
Dhupguri	2	319	8	1850	2	1422	9	5
Mal	1	133	1	725	1	844	2	0
Matiali	1	0	0	40	1	0	0	2
Nagrakata	1	0	0	45	1	7	0	0

Source: District Statistical Handbook, 1997-2018

In 2017-18 the numbers of tanks in all blocks area same as previous time periods. But in the case of Shallow Tube wells the numbers have increased from the past scenario. The highest numbers of STW was found in Jalpaiguri Sadar blocks with 1505 STWs. The numbers have increased eight times more than the past numbers. Dhupguri has 1422 STWs, where the number has increased four times more than the previous time. In Mynaguri block the numbers of STW has also increased and it was now 1161 STWs. Other blocks like Rajganj, Mal and Nagrakata the numbers of STW's have increased. Only in Matiali block the STW irrigation is still absence. In the case of DTW irrigation the numbers of DTWs was more or less similar in 2017-18. But the numbers of other sources of ground water have reduced tremendously from the previous time.

Plate 3.1 Dry Condition of a Tank during non-monsoonal season (December, 2018) in Rajganj Block of Jalpaiguri District.

Plate 3.2 Irrigation on Potato and Chilly Fields by using Shallow Tube Well in Jalpaiguri Sadar Block.

Plate 3.3 Irrigation has been done with the help of Deep Tube Well Irrigation System for Boro paddy cultivation during December to January in Jalpaiguri Block.

3.3 Utilization of Canal and River Lift Irrigation of Jalpaiguri District

Table 3.6 Spatio-temporal changes in area covered by Surface water Irrigation in Jalpaiguri District.

Years	Area in '000 Hectares		Years	Area in '000 Hectares	
	RLI	Canal		RLI	Canal
1997-98	2.28	36.19	2008-09	6.98	43.41
1998-99	4.12	37.95	2009-10	7.30	51.36
1999-00	4.12	40.95	2010-11	7.70	57.34
2000-01	6.69	45.91	2011-12	7.78	40.52
2001-02	5.71	45.95	2012-13	7.82	48.8
2002-03	7.89	49.59	2013-14	7.91	48.98
2003-04	4.83	46.1	2014-15	7.97	49.02
2004-05	4.83	46.1	2015-16	8.22	49.02
2005-06	4.83	46.1	2016-17	8.44	65.32
2006-07	6.60	46.1	2017-18	8.58	81.62
2007-08	6.72	46.1			

Source: District Statistical Handbook, 1997-2018

3.3.1 River Lift Irrigation

Lift irrigation is an irrigation method in which water is lifted from a water body (river, stream, pond, nala etc.) and spreading by canal or pipe and water is lifted with the help of a pumping set operated by an electric motor, diesel or solar engine.

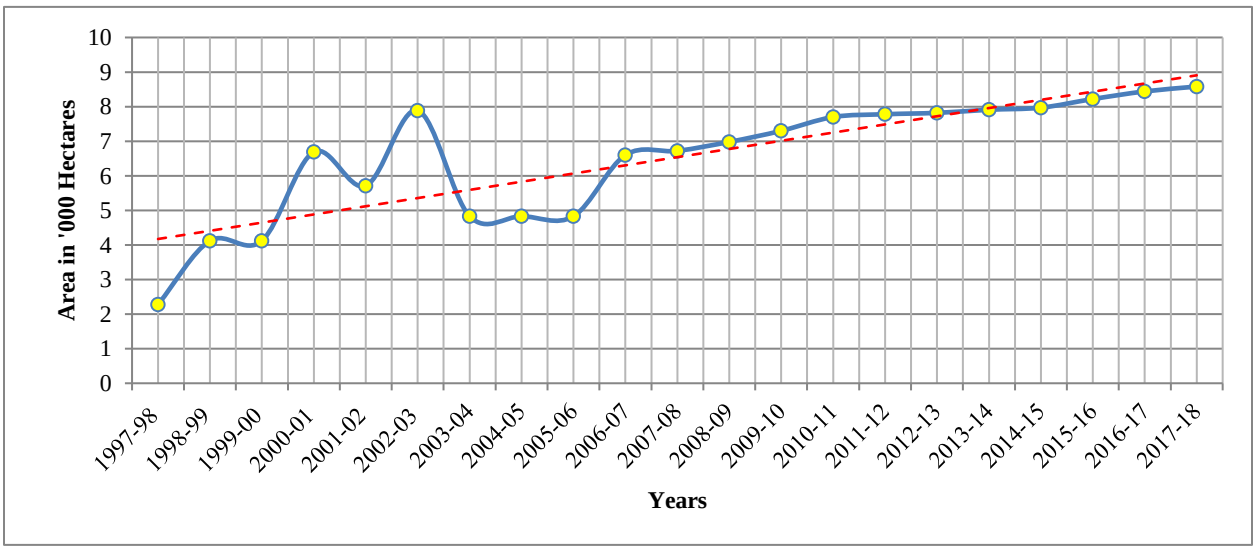
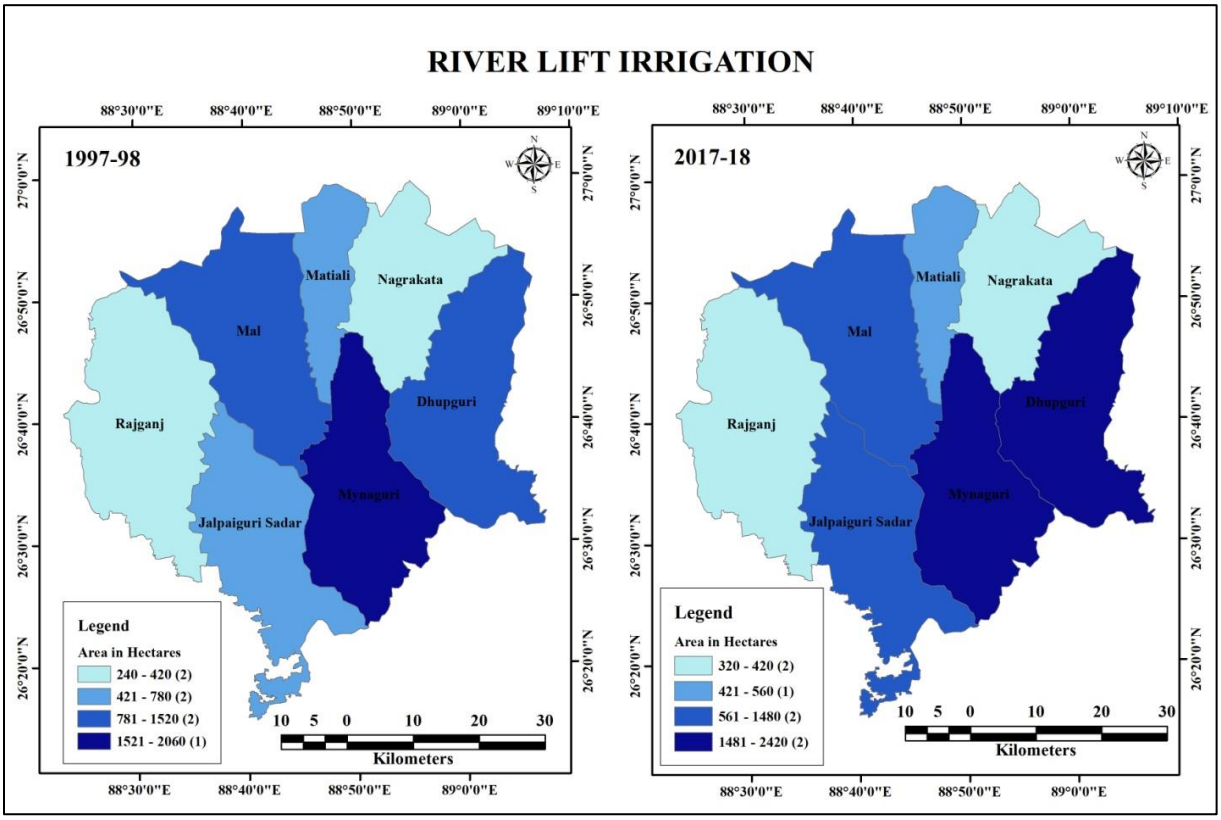


Figure 3.6 Spatio-temporal changes of area covered by River Lift irrigation in Jalpaiguri District.

Source: District Statistical Handbook, 1997-2018

Table 3.6 and figure 3.6 are showing the Spatio-temporal changes in area covered by River Lift irrigation from 1997 to 2018. In 1997-98 the area covered by RLI was 2280 hectares. The area under RLI was nearly doubled in just one year and in 1998-99 it was 4120 hectares. In2000-01 the area under RLI again increased to 6690 hectares. A slight reduction was observed in 2001-02, when it was covered 5710 hectares of cultivable land. From 2003 to 2006 the area was same with 4830 hectares. After that a continuous increasing trend was observed till 2017-18 and in this year the area under RLI was reached 8580 hectares of cultivable land.

Table 3.6 and map 3.5 are showing block level changes in area under RLI irrigation in Jalpaiguri district for two distinct time periods i.e., 1997-98 and 2017-18. In 1997-98 the highest RLI irrigation was occurred in Mynaguri block with 2060 hectares of cultivable lands under this irrigation method. Dhupguri stands 2nd in respect to area covered by RLI irrigation with 1520 hectares of cultivable lands. Following other blocks are Mal 1160 hectares, Jalpaiguri Sadar 780 hectares, Matiali 540 hectares, Rajganj 420 hectares and Nagrakata 240 hectares. In case of 2017-18 again Mynaguri has the highest area covered by RLI irrigation with 2420 hectares of cultivable lands. Dhupguri stands 2nd in respect to area covered by RLI irrigation in 2017-18. In this year Dhupguri has 2180 hectares of land under this irrigation method. All the blocks (except Rajganj) have increased the area under RLI irrigation in the same time span. The other blocks are Mal 1480 hectares, Jalpaiguri Sadar 1200 hectares, Matiali 560 hectares, Rajganj 420 hectares and Nagrakata 320 hectares.



Map 3.5 Block level utilization of River Lift Irrigation in Jalpaiguri District.

Source: District Statistical Handbook, 1997-2018

Prepared by the Researcher.

Table 3.7 Block level utilization of Canal and River Lift Irrigation in Jalpaiguri District.

Name of the Blocks	Area in Hectares			
	1997-98		2017-18	
	RLI	Canal	RLI	Canal
Rajganj	420	18145	420	46415
Jalpaiguri Sadar	780	11800	1200	25188
Mynaguri	2060	1250	2420	730
Dhupguri	1520	2020	2180	3635
Mal	1160	1200	1480	3378
Matiali	540	880	560	1042
Nagrakata	240	720	320	1096

Source: District Statistical Handbook, 1997-2018

3.3.2 Canal Irrigation

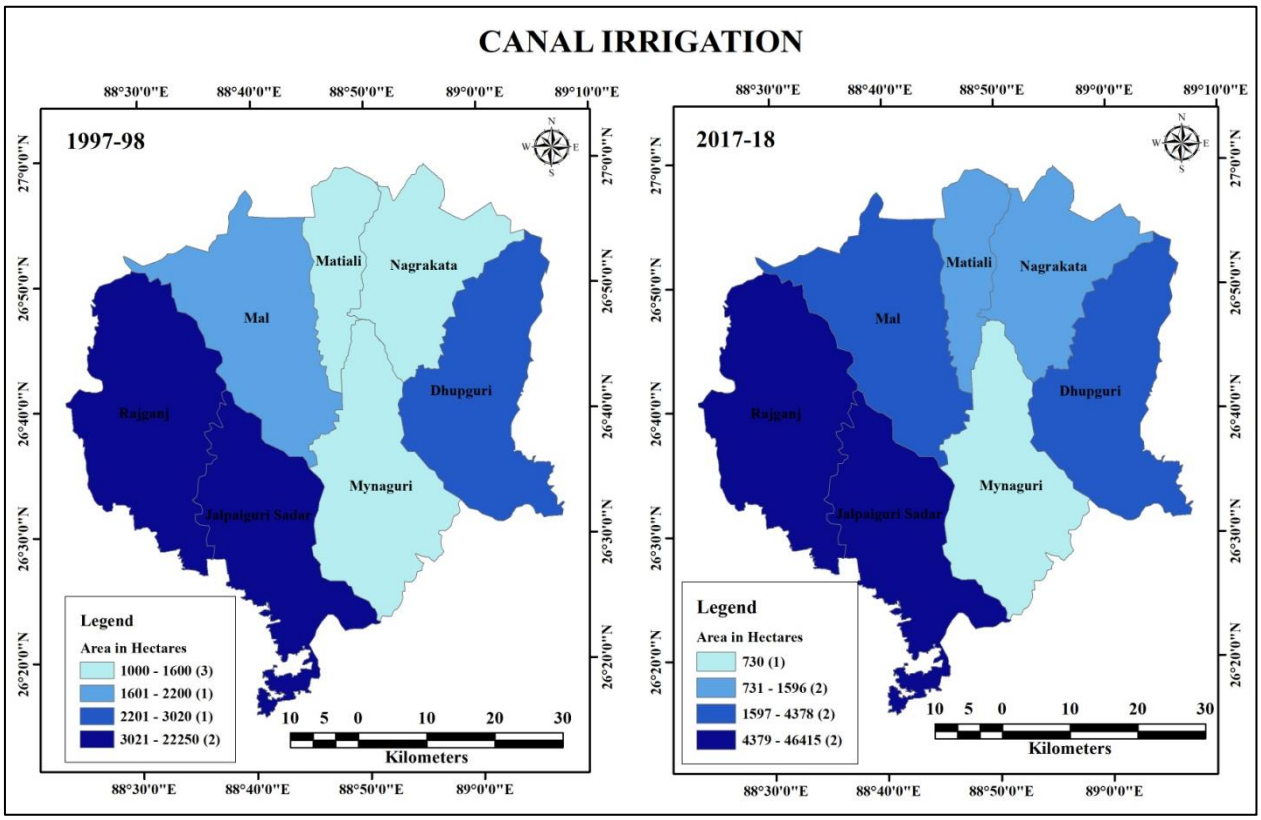
The canal irrigation of the district has taken a significant place from Teesta Barrage project. Though there had been block wise variation in the distribution of canal irrigation. Blocks like Rajganj, Jalpaiguri Sadar had significant reach of canals and hence the surface irrigation had developed here. Some of the blocks like Mal, Nagrakata and Matiali that lies in the foot hills of Darjeeling Himalaya could not possible to develop canal irrigation due to various geological and morphological factors. The other blocks i.e. Mynaguri and Dhupguri had also insignificant in terms of canal irrigation due to the absence of canals and infrastructure for canal irrigation. Thus the farmers of Mynaguri and Dhupguri blocks utilized ground water significantly than surface irrigation. Table 3.6 and figure 3.7 are showing the Spatio-temporal changes in area covered by Canal irrigation in the Jalpaiguri district from 1997 to 2018. In 1997-98 the area covered by Canal irrigation was more than 36000 hectares. The area under Canal irrigation increased every years from 1997-98 to 2002-03. In 2002-03 the area under Canal irrigation was 49590 hectares. After that a slight reduction was observed and till 2007-08 the area covered by Canal irrigation was 46100 hectares of cultivable land. In the one decade the year wise area covered by Canal irrigation have shown fluctuating trend and in 2017-18 the area was increased to 81620 hectares.

Figure 3.7 Spatio-temporal changes of area covered by Canal irrigation in Jalpaiguri District.

Source: District Statistical Handbook, 1997-2018

Table 3.7 and map 3.6 are showing block level changes in area under Canal irrigation in Jalpaiguri district for two distinct time periods i.e., 1997-98 and 2017-18. In 1997-98 the highest

area covered by Canal irrigation was found Rajganj, where 18145 hectares of cultivable land was under this irrigation. After Rajganj Jalpaiguri Sadar has the 2nd highest cultivable area covered by Canal irrigation, where 11800 hectares of cultivable land under this irrigation method. As the less extent of canals in other blocks of the district the area under Canal irrigation of those blocks were also less than Rajganj and Jalpaiguri Sadar blocks. In Dhupguri only 2020 hectares of cultivable area was covered by Canal irrigation. Followings were 1250 hectares in Mynaguri, 1200 hectares in Mal, 880 hectares in Matiali and 720 hectares in Nagrakata. Similar scenario has also been found in 2017-18 when most of the cultivable area of the district which are depends on canal irrigation was found in Rajganj and Jalpaiguri Sadar blocks.



Map 3.6 Block level utilization of Canal Irrigation in Jalpaiguri District.

Source: District Statistical Handbook, 1997-2018

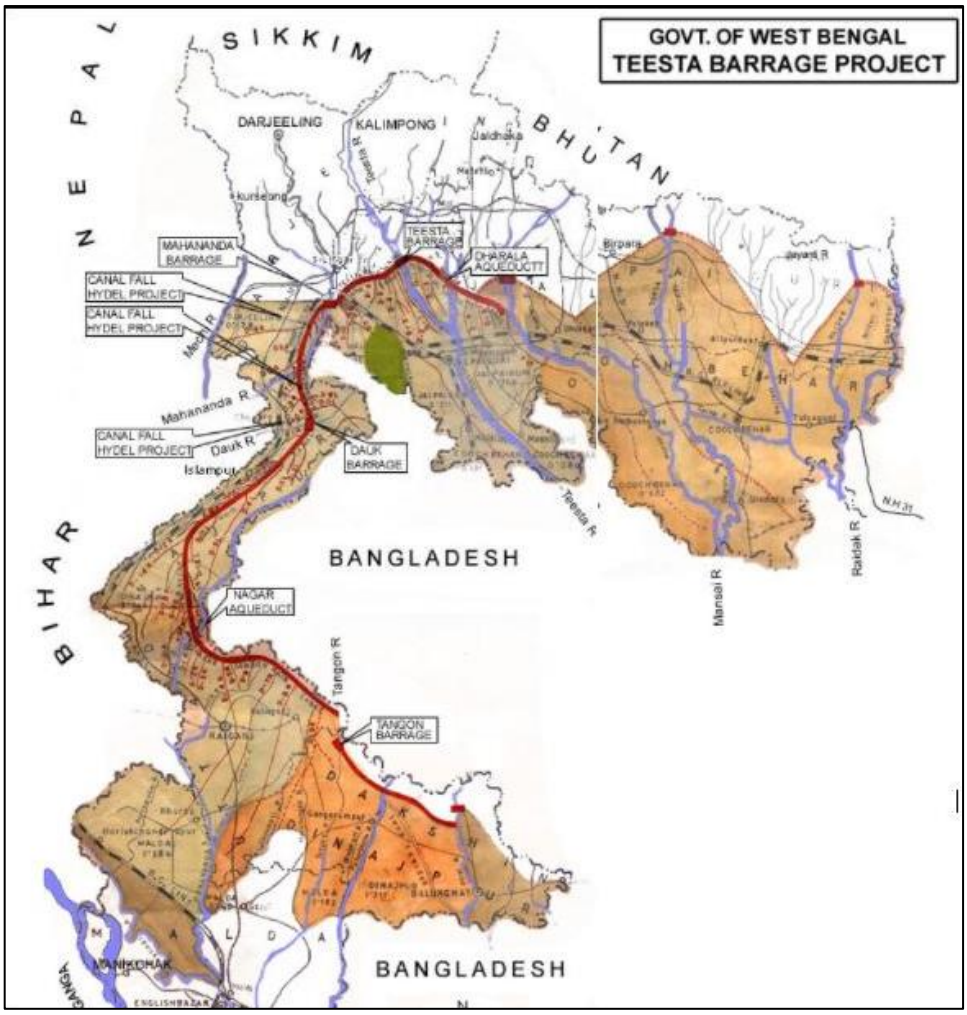
Though the total area covered by Canal irrigation in the district has increased manifold, but most of the areas are concentrated only two blocks i.e., Rajganj and Jalpaiguri Sadar. In 2017-18 Rajganj has the area of 46415 hectares of land under Canal irrigation. After Rajganj, Jalpaiguri

Sadar has the 2nd highest area covered by Canal irrigation with 25188 hectares. The extent of the canals still not reached completely in other blocks of the district. The area covered by Canal irrigation in other blocks of Jalpaiguri district are following 3635 hectares in Dhupguri, 3378 hectares in Mal, 1096 hectares in Nagrakata, 1042 hectares in Matiali and 730 hectares in Mynaguri block.

	
Plate 3.4 Water of Teesta river flowing through Teesta Mahananda Link Canal and this water distributed all over the Rajganj block by Many sub canals and then by many minor canals to the agricultural field.	**Plate 3.5** Ill-maintenance of Sub- Canal which distributes water from Main Canal to minor canals in Rajganj block
	
Plate 3.6 Irrigation water flowing through Concreted Minor Canals to the paddy filed in Jalpaiguri Sadar Block.	

3.4 Teesta Barrage Project for Irrigation in Jalpaiguri District

The Teesta Barrage Project is a large multipurpose water resources project in the northern part of West Bengal. This is the largest irrigation project when it will complete. This project lies over 6 district of North Bengal, namely Cooch Behar, Jalpaiguri, Darjeeling, Uttar Dinajpur, Dakshin Dinajpur and Malda.



Map 3.7 Teesta Barrage Project.

Source: Irrigation and Waterways Department, Govt. of West Bengal

The North Bengal plains are associated with high rainfall variability and it gets rainfall accounting for lower than average rainfall frequently. 90% of total annual rainfall in concentrated in 4 summer months followed by a long spell of time with rainfall averaging 0-50 mm. Often monsoon gets delayed and the agricultural fields suffer from acute shortage of water. Such gap between required water and available water in this region has to be met through the supply of irrigated water. Until the Teesta Barrage Project (TBP) there were literally no such large irrigation schemes in North Bengal. The Project has three different phases and the Project envisages utilization of potential of the Teesta River in the field of irrigation, hydropower generation, navigation and flood moderation. It planned to irrigate 922 thousand hectare land

under the 1st phase, generation of 650 MW electricity in the link between Ganga and Brahmaputra under the 3rd phase. The 1st phase was again divided into three stages which aimed to irrigate 546 thousand hectare land under the 1ststage, 223 thousand hectare under the 2nd stage and 153thousand hectare under the 3rd stage. The 1st phase of the project started in the year 1976 and is proposed to be completed by March"2015 which is still under progress (De, 2002). The 1st sub stage of Stage-I of Teesta Barrage Project envisages the following works:

a) Construction of a barrage across river Teesta at Gajoldoba in the Jalpaiguri district.

b) Construction of distributaries, minors, sub-minors and water courses covering a length of 2450.00 km (approx.) for sub-stage-1 of stage-I.

c) Construction of 27 Nos. of Regulator and fall structures, including 3 Nos. of Power Falls.

d) Construction of 166 Nos. of bridges on main canals including crossings of Railway Lines, National Highway, State Highway and Major District Roads.

e) Construction of residential and non-residential buildings, stack-yards, stores and go downs throughout the Project Area.

f) Construction of Inspection paths, approach roads and other allied works.

g) Two pick-up barrages, one across the Mahananda River at Fulbari in Jalpaiguri district and other across river Dauk at Chopra in Uttar Dinajpur district.

h) Construction of five main canals namely:

i. Teesta- Mahananda Link Canal for the length of 25.75 km.

ii. Mahananda Main Canal for the length of 32.33 km.

iii. Dauk Nagar Main Canal for the length of 80.20 km.

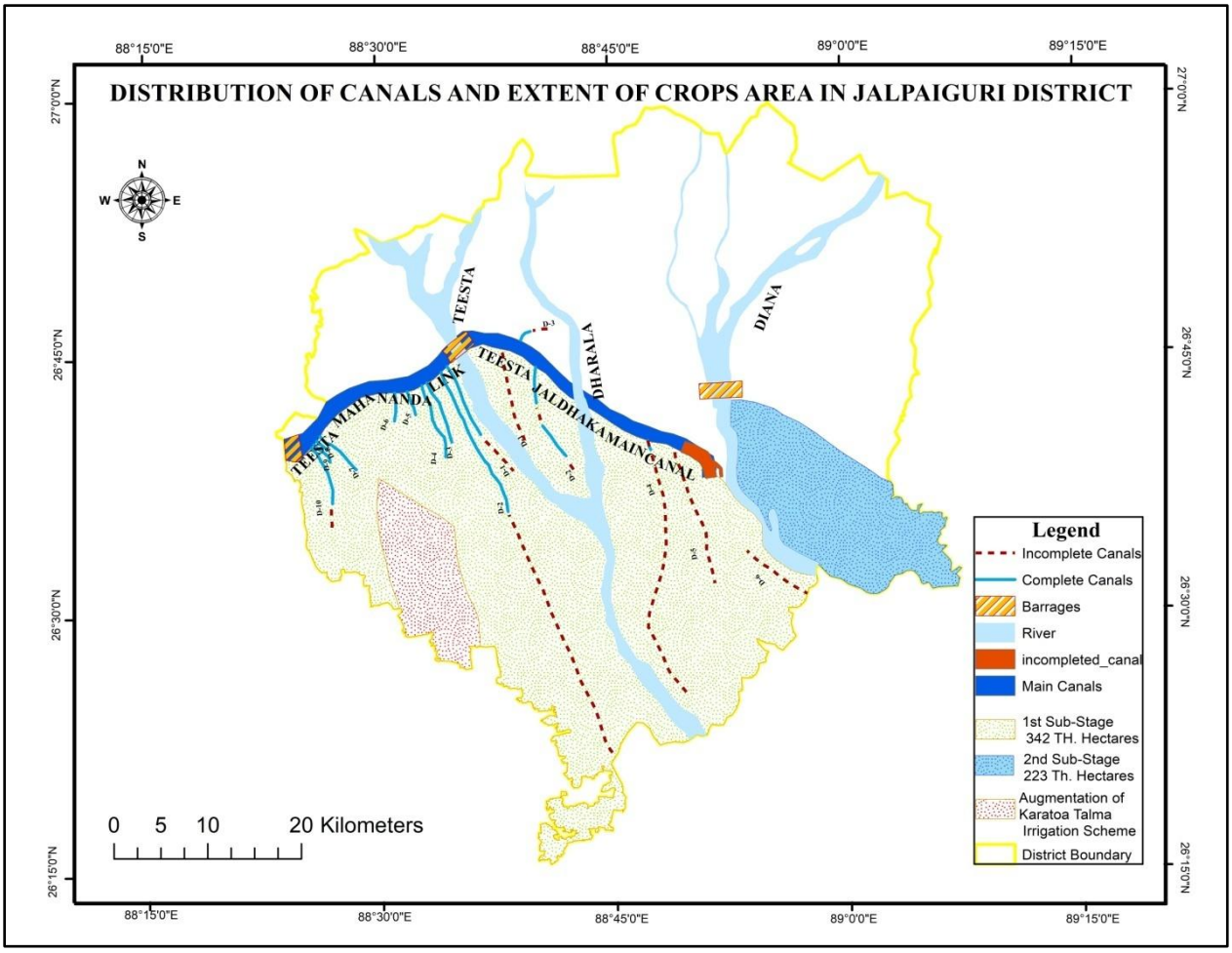
iv. Nagar Tangon Main Canal for the length of 42.20 km.

v. Teesta- Jaldhaka Main Canal for the length of 30.31 km.

The sub-stage I of first phase of Teesta Barrage Project, which concentrate Irrigation was started in the year 1975-76 and it was spread over mainly Jalpaiguri district. The district Jalpaiguri falls in the North Bengal region which compares unfavorably with the South Bengal districts in terms of general developmental parameters. Jalpaiguri is agriculturally backward with the lowest food grain productivity among all the districts in the state, being rated ninth among 18 districts in cropping intensity and twelfth in irrigation coverage. Compositely, in terms of agriculture development, Jalpaiguri was found to be in fourteenth position in the state (Chatterjee and Ghosh 2003). The predominance of canal irrigation among all sources of water is clearly reflected in the district, as out of a total irrigated area of 124700 hectares, around 81620 thousand hectares (65 per cent) is irrigated through canals; these are mainly through the Teesta Barrage Project and the Karotowa Barrage project, which also draws its water from the Teesta (Gob, 2018). The Teesta Barrage project consists of a series of five barrages, namely Jaldhaka, Teesta, Mahananda, Dauk, Nagor and Tangon, connected by link canals. The project thus takes an L shaped structure. Currently Teesta, Mahananda and Dauk barrages have been completed. The Teesta–Mahananda Link canal and Mahananda Main Canal along with its distribution structure are partially completed. Irrigation of certain patches has been taking place for the last 20 years (Ghosh 2005). The study focused on the Teesta–Mahananda Link Canal (TMLC) which passes through the Jalpaiguri district, over two blocks: Rajganj and Jalpaiguri Sadar. The major part of the distribution network of the TMLC has been completed. The TMLC is a case of Inter-Basin Transfer that links the mountain river Teesta, tributary of the Brahmaputra, to the Mahananda, a tributary of the Ganga. The project is one of its kind, where a mountainous river has been tamed and large areas in the plains are being irrigated, using its water without creating any reservoirs. Of the 10 distributaries coming out from the TMLC, this study was carried out over distributary D2 and Minor M3 that comes out from D2. D2 and M3 are spread over the Rajganj and Jalpaiguri Sadar blocks of the district. From the head of D2 to the tail end of M3 there are 4 gram panchayats (GPs) namely Mantadari and Shikarpur under Rajganj block and Belakoba and Bahadur under Jalpaiguri Sadar block. Thus the study area was spatially divided into head, middle and tail ends, whereby Mantadari and Shikarpur came at the Head, Belakoba GP at the middle and Bahadur GP at the tail end.

Table 3.8 is depicting the water distribution of major and minor canals in the season irrigation in Jalpaiguri District. As the sub-stage I of phase 1 of the Teesta Barrage Project in

ongoing the area covered by canal irrigation is mainly found in two blocks of the district. These blocks are Rajganj and Jalpaiguri Sadar. From the table it can be shown that there are total 10 main distributaries canals have been constructed till now and most of them lie in Rajganj and Jalpaiguri Sadar blocks. These distributaries further divided by minor canals to supply the water in the cultivable field during the irrigation season.



Map 3.8 Distribution of Canals and Crop Covered Area in Jalpaiguri District.
Source: CWC,CGWB, District Irrigation and Agriculture Department, 2017
Prepared by the Researcher.

Table 3.8 Seasonal Water Distribution of Major and Minor Canals for Irrigation in Jalpaiguri District.

Name of the Blocks	Canal Name	Canal Length	Villages and Mouza	Area Covered in Hectares
Teesta Mahananda Link Canal				
Rajganj	L.B.M.C	16.123	Chandor, Dadhigach,Sahebbari, Salguri, Mehendigach, Chariyapara, Jhakurapara, Majabari, Totaigach, Sudhani, Panikouri	1500
	D 1 L.B.M.C		Mehendigacn	121
	D-2 L.B.M.C	17.95	Sarkarpara, Patilavasa, Daktarpara	1400
	D-3 L.B.M.C	5.746	RGbelakoba, Kismat-sudhani	432
	R.B.M.C	8.987	Balaigach	86
	D-3 A.L.B.M.C	1.888	Ambari Falakata, Binnaguri, Sitaguri	540
	D-1 R.B.M.C	5.026	Jugivita, Mahanvita, Badalgach	360
	D-2 R.B.M.C	3.455	Ambari Falakata, Mahanvita Patharghata, Gadheyagach	440
	Distribuitary-1	23.235	Jangal Mahal, Pradhanpara	3402
	Minor 2 D2	1.86	Mastadari	150
	Minor 4 D2	1.74	Patkata	75
	Minor 5 D2	3.3	Patkata	300
	Distribuitary-3	5.22	Pansaguri, Jalarbari, Pradhanpara	750
	Distribuitary-4	6.45	Kundardighi, Lalitabari	700
	MINOR-1 D-4	1.75	Chhat-Maulanigach	50
	MINOR-2 D-4	3.3	Votpara, Laxmijote	100
	MINOR-3 D-4	1.65	Chakiavita, Jamidargach, Binnaguri	100
	Minor 4 D4	1.125	Dangapara	30
	D-5	1.59	Shimulguri	150
	D-6	1.46	Binnaguri	100
	D-7	4.011	Binnaguri	800
	D-8	0.61	Binnaguri	45
	D-9	2.78	Binnaguri	530
	Minor-2 D-9	1.35	Binnaguri	156
	D-10	13.99	Binnaguri, Sanyassikata	3200
	Minor 2 D10	10.2	Chattpradhanpara, Binnaguri, Sanyassikata	30
	Minor 4 D10	2.5	Paglarhat, Radhabari, Chobavita	30
	Minor 5 D10	1.5	Binnaguri	90
Jalpaiguri Sadar	Minor 1	4.75	Barpetia nutanbas	522
	Minor 2	1.94	Barpetia nutanbas, Patkata	231
	Minor 3	1.97	Angarbari, poyavita, Khalpara	295
	Minor 4	3	Angarbari, poyavita, Khalpara	236
	Minor 5	3	Pradhanpara	50
Rajganj & Jalpaiguri Sadar	Distribuitary-2	59.01	Angarbari, Poyavita, Chararpara, Belakoba, patkata, Shikarpur, Kharia 2, Nandanpur, kachuyavoulmari	10400
	Minor-2 D-2	1.86	Mastadari	150
	Minor-3 D-2	27.03	Bahadur, Jamdarpara, Chararpara, Belakoba, Patkata,Shikarpur, Kharia 2, Daltanbari, Garalbari	9300
Teesta Jaldhaka Main Canal				
Mal	D-1 T.G.M.C	8.341	W. Gachimari , Daligaon, Nekabasti, Golabari, E Daligaon, S Nahangsakali	1640
	D-1 A.T.G.M.C	2.87	Uttar Changramari, Dakshin Nahangsakali	298
	D-2 T.G.M.C	10.622	N &S Majgram, N & S Sariyapara, Chapadanga, S Khalpara	1760
	D-3 T.G.M.C	7.07	Majgram, Dhalabari, Kodalkati, Chikanmati	1080
	D-4 T.G.M.C	4.03	N.Jharmatiali, Chawkmoulani	800
Mynaguri	D-5 T.G.M.C	11.58	Kalamati, Kajaldighi	400

Source: CWC,CGWB, District Irrigation and Agriculture Department, 2018

3.5Correlation between area covered by different sources of Ground & Surface Water irrigation and Gross Cropped Area in Jalpaiguri District

The word 'Correlation' is used to denote the degree of association between variables. Correlation coefficient is one kind of bi-variate analysis where it can be showed that changes in magnitude of one variable are so associated with the changes in magnitude of other variables. For the analysis of correlation between the various sources of irrigation and net sown area, the researcher has used Karl Pearson's Product Moment Correlation Coefficient. Pearson (1920) systematized the analysis of correlation of coefficient and established a theory of correlation. It is a unit free measure of relationship between two variables and takes value in -1, +1. When the calculated correlation coefficient value close to +1 or -1, there is strong positive or negative relationship established between the variables.

Karl Pearson's Product Moment Correlation Coefficient -

$$\boldsymbol{r = \frac{\frac{\sum xy}{N} - \bar{x}.\bar{y}}{\sigma x.\sigma y}}$$

Where,

r = Product-moment correlation coefficient
N = Number of data pair
$\bar{x}$ = Mean of x
$\bar{y}$ = Mean of y
$\sum xy$ = Sum of the products of x and y
σx = Standard Deviation of x
σy = Standard Deviation of y

Table 3.9 Correlation Table between Irrigation Sources and GCA

Blocks	**Area in Hectares**						
	GCA	**Tank**	**STW**	**DTW**	**RLI**	**Canal**	**Others**
Rajganj	55310	130	585	200	420	46415	40
Jalpaiguri Sadar	51122	278	5450	800	1200	25188	160
Mynaguri	55300	360	4275	440	2420	730	200
Dhupguri	46102	320	6925	360	2180	3635	200
Mal	28550	116	3390	80	1480	3378	0
Matiali	5500	0	0	0	560	1042	80
Nagrakata	7137	21	35	0	320	1096	0
Value of r		0.86	0.65	0.76	0.58	0.51	0.62

Source: District Statistical Handbook, 2017-18

STW – Shallow Tube Well
DTW – Deep Tube Well
RLI – River Lift Irrigation
r – Pearson's Product Moment Correlation Coefficient

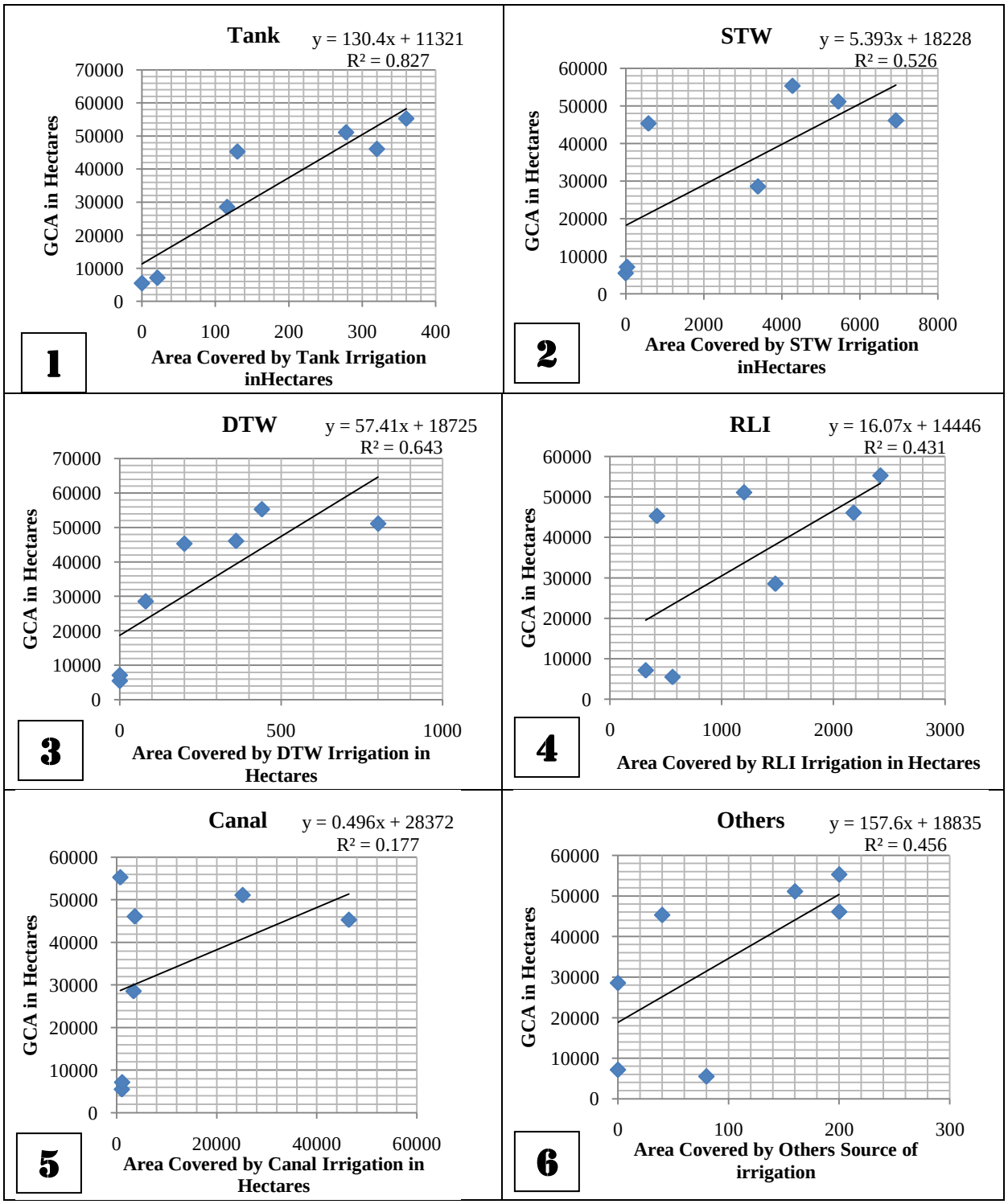


Figure 3.8 Correlation between areas covered by different sources irrigation and Gross Cropped Area of Jalpaiguri District.

Source: District Statistical Handbook, 2017-18

Prepared by the Researcher.

Table 3.9 and figure 3.9 are showing the correlation between different sources of irrigation and gross cropped area in Jalpaiguri district in 2017-18. The gross cropped area represents the total area sown once and/or more than once in a particular year, i.e. the area is counted as many times as there are sowings in a year. Here the researcher tries to correlate the area covered by different irrigation methods and Gross Cropped area to understand the impact of irrigation on agriculture. The value of r in Tank Irrigation (0.86), STW (0.65), DTW (0.79) and others (0.76) was more than 0.65 of correlation value, which denotes the high positive correlation between the area covered by above mentioned irrigation methods and gross cropped. Except these RLI (0.58), Canal Irrigation (0.51) and other sources (0.62) had also positive correlation with GCA. In the given scatter plots it can be shown that all trend lines which have drawn on the basis of correlation are showing positive trend. This reflects the positive relationship between area covered by different irrigation methods and gross cropped area.

3.6 Bad Effects of Irrigation

Irrigation is a system through which water is brought to land or soil by means of some artificial sources like as pipes, hoses and ditches. It is used to assist in the growing of agricultural crops, maintenance of landscapes and re-vegetation of disturbed soil in a dry land. Thus it is an important component for the crop cultivation, especially in the water deficient regions. But sometimes excess amount of irrigation water creates various types of problems including environmental, pedological as well as anthropological. The adverse effects of Irrigation found due to over irrigation or excess irrigation. In agricultural land, when the soil pores within the root zone of the crops get saturated with the subsoil water, the air circulation within the soil pores gets totally stopped. This phenomenon is termed as water logging. The water logging makes soil alkaline in character and fertility of the land is totally destroyed and the yield of crop is reduced. Again the soil contains several salts but all the salts are not suitable for growth of crops. The salts of sodium such as sodium carbonate, sodium chloride and sodium sulphate are harmful for the growth of plants. These salts are found in the deeper layer of soil. When the water table rises, the water dissolves these salts. Further by the capillary action, water containing these salts comes to the root zone and as the water evaporates there, the salts get deposited. The deposition of the salt is indicated by the white patches on the soil surface.

Table 3.10 Adverse effects of irrigation in Jalpaiguri District.

Types of Effects	Number of Farmers	Percentage
Water Logging	56	10
Soil Salinization	48	8.57
Drinking Water Problem	27	4.82
Social Relation	22	3.93
Health Problem	32	5.71

Source: Field Survey.

Prepared by the Researcher.

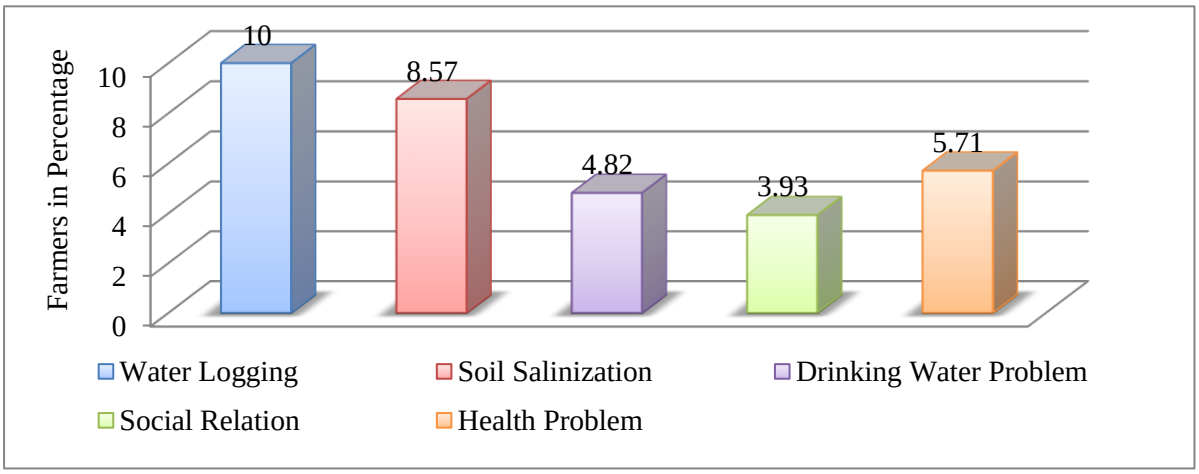


Figure 3.9 Adverse Effects of Irrigation.

Source: Field Survey.

Prepared by the Researcher.

The irrigation has brought smile to the millions faces of our farmers. It has revolutionized the agricultural sector of our country, especially in the northern states like Punjab, Uttar Pradesh, Haryana, Bihar and West Bengal. But it has some adverse impact as well, especially on environmental and socioeconomic aspects. From the primary survey the researcher has found some of adverse effects of irrigation in Jalpaiguri district. The blocks like Rajganj and Jalpaiguri Sadar where the Canal irrigation has well developed. Table 3.10 and figure 3.10 depicts Farmers respond on the adverse effects of irrigation. The researcher has conducted questionnaire based perception studies to understand the adverse effects of irrigation. And from overall studies the

farmers of Jalpaiguri Sadar and Rajganj block have responded with the asked questions. Nearly 10% of the total surveyed farmers confirmed that there has been the problem of water logging in the agricultural field, especially those which are close to the canals. Again 9% of surveyed farmers respond that during the Rabi season they used give limes for balancing the Salinization. 5% of farmers think that there is some problem of drinking water due to canal irrigation and 6% of farmers thought there has been some health problem like Malaria, Typhoid Dysentery etc. And sometimes there are serious fight have occurred between farmers for the canal water.

3.7 Problems related to Irrigation

Farmers of Jalpaiguri District have been facing a number of problems related to irrigation systems they are using for the crops cultivation. Some of the major problems are related to mechanical functions of motor pump, management and distribution of water from government sources, while other issues are related to higher pricing, irregular supply of electricity, lack of government funding. The problems of farmers related to irrigation tend to vary from season to season and region to region within the study area. To understand the problems facing by the farmers related to irrigation the researcher conducted a sample survey in the study area.

Table 3.11 Problems related to irrigation facilities in Jalpaiguri District.

Blocks	**Problems Related to Irrigation**									
	Insufficient water supply		**Inadequate Electricity**		**Minimum coverage**		**High Cost**		**Non-availability of technicians**	
	No	%	No	%	No	%	No	%	No	%
Rajganj	21	9.4	11	7.59	8	7.62	25	10.96	30	12.24
Jalpaiguri Sadar	29	13.0	15	10.34	5	4.76	12	5.26	22	8.98
Mynaguri	41	18.4	21	14.48	15	14.29	35	15.35	36	14.69
Dhupguri	25	11.2	24	16.55	18	17.14	34	14.91	42	17.14
Mal	45	20.2	19	13.10	12	11.43	40	17.54	31	12.65
Matiali	28	12.6	23	15.86	22	20.95	38	16.67	38	15.51
Nagrakata	34	15.2	32	22.07	25	23.81	44	19.30	46	18.78
Total	**223**	**100**	**145**	**100**	**105**	**100**	**228**	**100**	**245**	**100**

Source: Field Survey.

Prepared by the Researcher.

Table 3.11 depicts the farmer's response related to the problems that they have faced on irrigation. Out of 560 sample farmers 223 of them have faced insufficiency in water supply during the irrigation to their crops. Out of this 223 farmers, 21 (9.4%) of Rajganj, 29 (13%) of Jalpaiguri Sadar, 41 (18.4%) of Mynaguri, 25 (11.20%) of Dhupguri, 45 (20.20%) of Mal, 28

(12.6%) of Matiali and 34 (15.20%) farmers of Nagrakata have faced insufficiency in water supply during the irrigation to their crops. Total 145 farmers of the study area have faced electricity shortage during the irrigation process, which have hampered the irrigation process for the crop cultivation. Again 228 sample farmers have responded that the water of irrigation has minimum coverage to the crop field. In case of non-availability of technicians for repairing and installation of different pump set (solar, electric, diesel) out of 560 farmers, 245 have thought that during any mechanical problems or installation of new pump set, the technicians are not available in the study area.

3.8 Ongoing Government Schemes for Irrigation Development in Jalpaiguri District

The national as well as the state government have given fund to develop and enhance the irrigation facilities in the study area. The biggest irrigation scheme of north east India i.e. Teesta barrage project has started long ago and presently it ongoing. Except this various works are going on in the district to develop the irrigation methods in the district under the various government schemes. Table 3.12 has revealed the ongoing schemes for irrigational development in Jalpaiguri district under various Government departments. Under the ministry of water resource the AIBP scheme is going on and under this scheme both major and minor irrigation activities is also going on. Total 4672 cumecs of water has to be created and total 19293 hectares of cultivable land has to be covered by these scheme. Under the ***'Har khet ko Pani'*** scheme lift irrigation and ground water development through bunding is going on in the district. Total 11012 cumecs of water has to be created to cover 26716 hectares of cultivable land in the district. Construction of field channels is also going on under this scheme. Total 550 cumecs of water is to be created by the field channels to cover 27623 hectares of agricultural land.

Under the ***'Per Drop More Crop'*** scheme government is constructing the modern irrigation systems (Drip and Sprinkler). Under the DPAP (Drought Prone Area Programme) scheme total 16 cumecs and 3320 cumecs of water capacity have been created which will cover 1145 hectares of cultivable land under Drip irrigation and 9041 hectares under Sprinkler irrigation over the next 5 to 7 years. Under the non DPAP scheme total 195 cumecs of water capacity have been created which will cover 1115 hectares of cultivable land through drip and sprinkler irrigation in Jalpaiguri district. The construction of drought proofing through check dams and on farm development is also going on this scheme. Under the PMKSY the constructions of various

ponds, check dams, Nallah bunds, percolation tanks, fishery ponds etc. are going on. In this scheme both newly created and renovated irrigation facilities are ongoing in Jalpaiguri district.

Table 3.12 Ongoing Schemes for irrigation development in Jalpaiguri District.

Schemes	Activities	Total capacity (cum)	Command Area	Period of Implementation (Years)
AIBP	Major irrigation	78	4385	5 to 7
	Surface Minor irrigation	4594	7484	5 to 7
Har Khet Ko pani	Ground water development Through bunding	9382	11808	5 to 7
	Lift irrigation	1630	14908	5 to 7
	Lined field channels	325	23123	5 to 7
	Unlined channels	225	4500	5 to 7
	Micro irrigation	8	2000	5 to 7
Per Drop More Crop	DPAP Drip	16	1145	5 to 7
	DPAP Sprinkler	3320	9041	5 to 7
	Non-DPAP Drip	95	15	5 to 7
	Non-DPAP Sprinkler	100	1100	5 to 7
	Drought proofing through check damps/water harvesting structure	248	1694	5 to 7
	Secondary storage structure	150	1050	5 to 7
	On farm development (distribution pipe/raised bed & furrow system etc.)	28000	3625	5 to 7
PMKSY Watershed	Newly created			
	farm ponds	2947	1740	5 to 7
	Check dams/spill way	48	544	5 to 7
	Nallah bunds	315	2250	5 to 7
	percolation tanks	30	8	5 to 7
	fishery ponds/cattle ponds	1570	790	5 to 7
	Renovated			
	farm ponds	2232	2652	5 to 7
	Check dams/spill way	0	650	5 to 7
	Nallah bunds	0	290	5 to 7
	percolation tanks	0	0	5 to 7
	other ground water recharge structure	0	600	5 to 7
	fishery ponds/cattle ponds	600	282	5 to 7

Source: MOA & FWDAC & FW, 2017-18

3.9 Conclusion

The study Status of Irrigation in Jalpaiguri district is very significant to understand the present scenario and future prospects of irrigation. In this chapter researcher has attempted to analyze status of irrigation in the district. From the finding of research, it can be said that the district was

largely dependable upon ground water irrigation before the Teesta barrage project. After the construction of various canals, the farmers had shifted their irrigation practice from ground water to Canal irrigation. In this respect the farmer of Rajganj and Jalpaiguri block have started using canal water significantly for irrigation than the other blocks. As these two blocks are under the Teesta irrigation project and the construction canals have been completed here, and more cultivable area are under canal irrigation than other methods, it helped the farmers to produce more crops during non-monsoonal seasons.

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