Chapter 3
Nilwande Dam: Catchment and Command Areas

3.0 Introduction

In the preceding chapter various geographical profiles of the study area have been studied which are considered in the construction of the dam and to develop the canal network in the command area. However, the geological structure, physiographic region, differential degree of slopes, types of soil and climatic characteristics influence the cropping pattern and water requirement of the area. To get massive and sustainable development in the agriculture sector, immense irrigation network has been accepted as a landmark. Water availability is appropriate for domestic consumption, livestock, but very limited for irrigation.

The rainwater is the main source of fresh water, but it is varied according to place and time. In the developing countries like India, it is essential to undertake maximum development in irrigation whereas,
irrigation means the artificial supply of water to the soil for development of the crop (Shinha, 2011). Therefore, water must be stored and convey or to be made accessible when and where it is needed. After Independence, the government of India invested a huge amount in irrigation projects for securing irrigation facilities in agriculture sector all over the country. The Upper Pravara Project –II (Nilwande dam) is one of the major projects on the Pravara river in Godavari Basin at Akole tehsil of Ahmednagar district. This chapter pays attention to the silent features of the Nilwande irrigation project.

3.1 River Pravara

The Godavari basin is one of the major river basins in western Maharashtra, which covers maximum part of Maharashtra. The Godavari river basin is divided in to the two parts, as upper basin and lower basin while the upper basin is divided in to further two parts, Godavari basin without Pravara-Mula and Pravara –Mula basin. Pravara river is a main tributary of Godavari river and Mula is a tributary of Pravara river so its basin has also covered in Pravara basin. The historically famous ‘Jorve civilization’ was developed within Pravara basin (MSG, 2013). The origin of Pravara river is on the eastern slope of the Western Ghat (Shyadari ranges) within the Kulang and Ratanghad peaks. It is about 1070m high from sea level. It flows toward east about 230 km and the confluence with Godavari at a height of about 460m from sea level which is called Pravara Sangam. The average height of Pravara basin is about 500 m. The latitudinal and longitudinal extension of the river basin of Pravara-Mula is 19°33’N to 73°46’E respectively and it has covered the total 6569 sq.km catchment area. The distribution of Pravara river basin is very uneven, about 95.69% area of catchment is covered by Ahmednagar district, 2.83% and 1.48% catchment area covered by Nashik and Pune district respectively. Adhala, Krushnavant, Mhalungi, and Mula rivers are the main tributary of Pravara river along with Dhamoli, Dev Digras, Vandarah, Lendaga rivers and Tolkhandi, Muimala, Shivadi, Devi, Dharan, Marsingh-Gora, Lendhora, Kazi and Mandapur streams also meet Pravara river. There are two major and two
medium irrigation projects in the upper Pravara basin and catchment area. The major projects are Bhandardara and Nilwande and the medium projects are Adhala and Bhojapur.

3.2 History of Nilwande Dam

In the second half of the nineteenth century British government had taken initiative to overcome the drought prone situation in Ahmednagar district. The Deccan Riots Commission gave priority to available drinking water in the drought prone areas of Ahmednagar. According to commission's report Mr. Arthur Hill, (chief engineer for irrigation) two sites were observed for dam construction, these are Mhaladevi and Bhandardara. Initially British government decided to construct soil dam at Mhaladevi but due to uncertainty about the strength of soil they started to built the dam with stone and lime in 1910. The construction was carried out under the surveillance of the chief executive engineer Arthur Hill later named it ‘Lake Arthur Hill’ after completion, in 1926. The inaugural function of the dam was organized in the presence of Sir Lesli Wilson, Governor of Bombay hence the dam is called ‘Wilson Dam’. Today it’s called ‘Bhandardara’ Dam, because of the local village name Bhandardara.

The Mhaladevi (Nilwande) project was taken in hand by the government of Maharashtra in 1970. The detailed investigations for a major irrigation project was carried out and four alternative dam sites were suggested i.e. Mhaladevi, Sawantwadi, Chitalwedhe and Nilwande. Amongst the four sites Mhaladevi was selected for dam construction and approved by the administrative government of Maharashtra in 1970 with expenditure Rs.793.31 lakh. The project envisaged gross storage of 6.343 T.M.C. to irrigate about 18848 ha area from Akole, Sangamner, Shrirampur, and Kopargaon Tehsils of Ahmednagar district with left bank canal of 72 km length. The gross annual utilization was proposed 7.82 T.M. C. at 75 per cent dependability. The Mhaladevi project report was revised without any changes in 1977 with expenditure Rs.1586.78 lakh. Under this project site 1400 ha area from 14 villages was submergence and affected 3763 people (as per census, 1971).
In 1977 affected people from Mhaladevi vigorously opposed the construction of dam to save their costly Bagayat land and 6 villages from submergence and minimize the problem of rehabilitations. To mitigate the problem of rehabilitation, the governments of Maharashtra shifted the dam site near the village Citalvedhe. The detailed project report of this site with high level left and right bank canal and eight monthly cropping patterns were prepared in 1980 with expenditure Rs. 7000.23 lakh. The project report again updated with D. S. R. for 1983-84 and revised cost with Rs.10275.34 lakh in 1984. The construction activities such as excavation of main dam, and colony building at dam site started during 1977. However the project also affected people from Citalvedhe and Nilwande hence, there was very strong conflict after the construction activities of dam during 1978 to 1992 for their main demand of rehabilitations.

The project affected people, approached the Hon. Ministry for Adiwasi Development Forest and Social Forestry with a new proposal in which they suggested suitable site for a dam near the Nilwande village so as to avoid the maximum loss of the highly irrigated and highly fertile lands being going under the water of the project.

. The government of Maharashtra investigated the site and approved the site which was 600 mt from the prefixed location at Nilwande and revised the cost Rs.23440.34 lakh in 1993. Finally the work of dam construction was started in 1993 and completed in 2011.

3.3 Silent features of Dam:

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Particular</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.3.1</td>
<td>Purpose of the Project:</td>
<td>An Irrigation project on the Pravara river near the Nilwande village to irrigate an area of 64260 ha of Akole, Sangamner, Kopargaon, Shrirampur, Rahata and Rahuri Tehsils from Ahmednagar district and Sinnar tehsil from Nashik district.</td>
</tr>
</tbody>
</table>
3.3.2 **Source:**

River Pravara, a right bank tributary of Godavari, near village Nilwande, Tehsil Akole, Ahmednagar district.

i. State

Maharashtra

ii. Region

Western Maharashtra

iii. Toposheet No.

47 /E/14

iv Location

19° 32' 45" N Latitude

73° 54' 15" E Longitude

It is approachable on Kolhar-Ghoti state highway no.44 up to Vithe there after ordinary road, the distance being about 44 Km from Sangamner.

3.3.3 **Yield and Utilization :**

i. Catchment Area

202.21 Sq. Km

78.07 Sq. Miles

ii Total Catchment Area Including Bhandardara

323.95 Sq. Km

125.07 Sq. Miles

iii Gross Utilization

326.06 M. Cum

11.50 T.M.C.

iv Net Utilization

313.46 M.Cum

11.05 T.M.C.

3.3.4 **Dam and Reservoir :**

i. Gross Capacity

236.00 M.Cum

08.32 T.M.C.

ii. Dead Storage

07.25 M.Cum

0.256 T.M.C.

iii. Live Storage

228.75 M.Cum

08.064 T.M.C.

iv. M.W.L. (for design flood)

649.23 M

2130.02 ft

v. F.R.L.

648.00 M

2125.99 ft
vi. Top of Dam  652.00M  2139.12 ft
vii. M.D.D.L. for high Level outlet  618.150M  2028.05 ft
viii. Crest R.L.  641.50M  2104.66 ft
ix. Sill Level of L.L. outlet  601.00M  1972.00 ft
x. M.D.D.L. for L.L. outlet const. sluice sill level  614.00M  2014.44 ft
xi. Sill level of high level Nilwande canal  613.00M  2011.16 ft
xii. Deepest river bed level  584.94M  1919.42 ft
xiii. Area under submergence  783.46Ha  1935.15 Acres
xiv. Area require for other purpose  216.61Ha  535.02 Acres
xv. Total area require for head work  1000.07Ha  2470.17 Acres
  a. Bagayat  29.24Ha  72.22 Acres
  b. Jirayat  545.73Ha  1347.96 Acres
  c. Revenue  177.25Ha  437.80 Acres
  d. Forest  247.85Ha  612.19 Acres
xvi. Maximum height of dam in river bed  74.50M  244.42 ft
xvii. Total length of dam  533M  1748.69 ft

3.3.5 **Spillway:**

a. Type  Gated with bucket energy dissipates
b. Designed flood P.M.F.  
3700cumecs  
7040cumecs  
248584  

c. Depth over crest  
6.50M  
21.32 ft  
72M  
236.16 ft  

d. Length of spillway  
3.3.6 Outlet Location:  
i. Combined irrigation cum power outlet  
1125M  
3680 ft  
1161M  

ii. Power outlet Unit- 1  
3809.06 ft  
1173M  
3848.43 ft  

Unit- 2  

iii. Const. sluice  
1305M  
4281.50 ft  

iv. River Outlet  
1480M  
4855.65 ft  

3.3.7 Canals:  
i. Length  

a. L.B.C  
85 Km  
52.80 Miles  

b. R.B.C.  
96.50Km  
59.94 Miles  

ii. Full supply discharge  

a. L.B.C.(Ch.0-2706)  
41.05cumecs  
1450 cusecs  

b. L.B.C. (Ch.2706 onward)  
26.40cumecs  
932 cusecs  

c. R.B.C.  
14.38cumecs  
508 cusecs  

d. Low level outlet  
50cumecs  
1765.68 cusecs
iii. R.L. of outlet sill

<table>
<thead>
<tr>
<th>Description</th>
<th>R.L. (M)</th>
<th>H.D. (ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Combined L.B.C.</td>
<td>613</td>
<td>2011.16</td>
</tr>
<tr>
<td>R.B.C.</td>
<td>609.80</td>
<td>2000.75</td>
</tr>
<tr>
<td>L.L. Outlet</td>
<td>601.00</td>
<td>1972</td>
</tr>
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</table>

iv. Section at Head

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>a. L.B.C. (Ch. 0-2706)</td>
<td>14.50</td>
<td>47.57</td>
<td>1 in 5000</td>
<td>3.10</td>
<td>10.17</td>
<td>1.00</td>
<td>3.28</td>
<td>Unlined two seasonal canals</td>
</tr>
<tr>
<td>b. L.B.C. (Ch. 2706 onwards)</td>
<td>10.05</td>
<td>32.97</td>
<td>1:50000</td>
<td>3.00</td>
<td>9.84</td>
<td>0.90</td>
<td>3</td>
<td>Unlined two seasonal canals</td>
</tr>
<tr>
<td>c. R.B.C.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

“Sustainable Modeling of Gravitational Pipeline Irrigation System: A Geographical Focus on Left Command Area of Niliwande Dam in Ahmednagar District”
Bed width 7.80M
25.59 ft

Bed Slope 1:3333

F.S.D. 2.15M
7.05 ft

Free Board 0.90M
3 ft

Description Unlined two seasonal canals

3.3.8 Command Area:

i. Gross command area 111090 Ha
274400 Acres

ii. Culturable Command area 86100 Ha
212660 Acres

iii. Irrigable area 64260 Ha
158722 Acres

iv. Annual irrigation 64260 Ha
158722 Acres

Source: Upper Pravara Project (Nilwande II) Report

3.4 Catchment Area:

Catchment area of the dam denotes an identification of region where rainwater is collected and drains into the dam. It also comprises available surface water from rain and ground water in the region. The amount of collected water in the dam depends on the catchment area’s rainfall, slope, and vegetation. Basically Nilwande dam has two catchment areas comprises the Bhandardara catchment and the second one is Bhandardara to Nilwande. The Bhandardara catchment area spread over 121.74 sq. Km, which includes the eastern slope part of the Western Ghat with many peaks. Physiographically, this catchment lies in mountains which have covered 3.73 percent area (Table 2.2). The Maximum and minimum elevation of catchment is 1450 m and 585 m respectively. The hilly area has rocky and muriy surface at maximum
elevation and have good slopes. The valley region is covered by the sparse vegetation.

It is observed that the catchment area of Bhandardara lies in the high rainfall zone of the Pravara valley. The maximum precipitation is concentrated in mountain area from Ghatghar to Malegaon. According to the last thirty years' rainfall records (1949-1980) the annual average flow of this catchment is 546.45 M. Cum (19.29 TMC) against the utilization of Bhandardara dam which is about 376.61 M. Cum (13.20 TMC). Therefore, the surplus water about 169.87 M. Cum (5.29 TMC) from this catchment is trapped into Nilwande dam.

The second catchment area also lies in the north side mountain region of the study area. It has occupied 202.21 sq. km. area from below Bhandardara dam up to Nilwande dam. The region of second catchment is comparatively low rainfall area than Bhandardara catchment. The rainfall data analysis from 1949 to 1980 and annual average flow observed 147.04 M. Cum (5.19 TMC) in this catchment area.

Finally, the total catchment area of Nilwande dam is 323.95 sq. km. The annual average flow into Nilwande dam from both catchments is calculated about 3.16.91 M. Cum (11.18 TMC). The available water will used for canal irrigation under two seasonal crops in the scarcity area of Ahmednagar and Nashik district and drinking purposes.

3.5 Command Area:

The benefited area of projects is called command area. The command area is irrigated from the scheme and geared up for cultivation also includes electricity. The command area of Nilwande dam has been influenced by the regional physiographic distinctiveness. The project will serve the scarcity area where the Kharif crops could not take fully because of inadequate and venerable rainfall. Along with the Nilwande left canal there are other irrigation canals in the study area. Figure 3.2 shows the existing canal and the area under the canal irrigation of the respective canal system.
Figure 3.1: Niliwande Dam Catchment Area
3.5.1 Godavari Right Canal

The northeast sides of study area provide the irrigation facility by Godavari right canal. This canal system covered about 877 sq.km. area (Table 3.1) from Kopargaon, Rahata and Shrirampur tehsils. Godavari right canal instigate from Nandur Madhmeshwar major irrigation project at Nashik district on Godavari river.

3.5.2 Nilwande Left Canal

The central part of the study area is covered by Nilwande left bank canal. It originates from down side of Nilwande dam about 85 km towards the east. This canal will feeds about 907.04 sq.km. areas for irrigation in Akole, Sangamner, Sinnar, Kopargaon, Rahata and Shrirampur tehsil. The Nilwande left canal is instigated from the Nilwande Major Irrigation Project, located at Akole tehsil of Ahmednagar district.

3.5.3 Nilwande High Level Left Canal

The western left side of Nilwande left canal, high level pipeline canal provides an irrigation facility to 12.70 Sq.Km. in Akole tehsil. The sill level of the high level canal is 627.40 m. and length is 27 km. The Nilwande left high level pipe canal is activated from the Nilwande Major irrigation project located at Akole tehsil in Ahmednagar district.

3.5.4 Pravara Left Canal

The southern part of the study area is delimited by Pravara river up to Ozar ketiweir. The Ozar ketiweir is divided Pravara river flow in left bank and right bank canal system. The Ozar ketiweir is 87 km below from the major irrigation project Bhandardara dam. This canal serves irrigation facility for 424.92 sq.km. area (Table 3.1) in Sangamner, Rahata, Shrirampur and Newasa Tehsil.
3.5.5 Adhala Canal

The northwest side of the study area has covered by the Adhala irrigation canal system. The Adhala medium irrigation project is located at Devthan (Akole Tehsil) on Adhala river, the tributary of Pravara. This canal feeds the irrigation on 63.35 sq.km. land in the Akole and Sangamner tehsils.

3.5.6 Bhojapur Canal

The east side of Adhala canal, Bhojapur canal has served the irrigation facilities in Sinnar and Sangamner tehsils. The Bhojapur medium irrigation project has located on Mhalungi river which is the tributary of Pravara. This canal system irrigates about 45.80 sq.km areas.

It is observed from the data collected from Adhala and Bhojapur dam that, these medium irrigation projects do not fulfill irrigation need regularly in the command area because of low rainfall in the catchment or not sufficient storage water in dam frequently. The table 3.1 shows the irrigation areas in the study area.

Table 3.1

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Canal System</th>
<th>Area in sq.km</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Godavari Right Canal</td>
<td>877.00</td>
</tr>
<tr>
<td>2</td>
<td>Nilwande Left Canal</td>
<td>907.04</td>
</tr>
<tr>
<td>3</td>
<td>Nilwande High Level Left Canal</td>
<td>12.70</td>
</tr>
<tr>
<td>4</td>
<td>Pravara Left Canal</td>
<td>424.92</td>
</tr>
<tr>
<td>5</td>
<td>Adhala Canal</td>
<td>63.35</td>
</tr>
<tr>
<td>6</td>
<td>Bhojapur Canal</td>
<td>45.80</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>2330.80</strong></td>
</tr>
</tbody>
</table>

Source: Command Area Development Corporation, Ahmednagar.
Figure 3.2: Existing Canal and Area under Canal Irrigation
The Command Area Development Corporation, Ahmednagar produces the proposed command area of left and the right bank canal of Nilwande project, which is shown in the figure 3.3.

The total gross proposed command area of the project is 111090 ha. from Ahmednagar and Nashik district (Table 3.2). Within that 86100 ha is a culturable command area and only 64260 ha will gross irrigable area from the left bank canal and right bank canal. The left bank canal GCA is 75870 ha, CCA is 58800 ha. and the gross irrigable area is 43886 ha. Whereas the right bank canal have less area which is 35220 ha. GCA 27300 ha., CCA and 20374 ha. gross irrigable area. The proposed irrigation facilities in the proposed command area are give in detail in the below table.

**Table 3.2**

Proposed project Command Area (in hectares)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Canals</th>
<th>Gross Command area</th>
<th>Culturable Command area net</th>
<th>Gross Irrigable area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Left Bank Canal</td>
<td>75870</td>
<td>58800</td>
<td>43886</td>
</tr>
<tr>
<td>2</td>
<td>Right Bank Canal</td>
<td>35220</td>
<td>27300</td>
<td>20374</td>
</tr>
<tr>
<td>3</td>
<td>Total</td>
<td>111090</td>
<td>86100</td>
<td>64260</td>
</tr>
</tbody>
</table>

Source: Command Area Development Corporation, Ahmednagar.
Figure 3.3 Command area of Nilwande Dam
The left bank canal is purposed as contour canal so that, it has lined according to the slope of the region. The command area of LBC is characterized by different type of land use like irrigated, unirrigated land, settlements and barren land (figure 4.5) LBC has covered 43886 ha. area from the five tehsils of Ahmednagar district and one tehsil of Nashik district. Table 3.2 shows the tehsil wise area of the proposed LBC command area with number of benefited villages. In two districts, there area total 118 villages will be benefited by the left bank canal of Nilwande dam. Out of that maximum 46 villages from Sangamner tehsil and minimum villages will be covered from Shrirampur tehsil in the proposed command area.

Table 3.3

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Tehsil</th>
<th>Irrigable area in ha.</th>
<th>% to total area</th>
<th>No. of Villages benefited</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Akole</td>
<td>1964</td>
<td>4.48</td>
<td>14</td>
</tr>
<tr>
<td>2</td>
<td>Sangamner</td>
<td>15393</td>
<td>35.07</td>
<td>46</td>
</tr>
<tr>
<td>3</td>
<td>Rahata</td>
<td>17231</td>
<td>39.26</td>
<td>37</td>
</tr>
<tr>
<td>4</td>
<td>Shrirampur</td>
<td>999</td>
<td>2.28</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Kopargaon</td>
<td>5666</td>
<td>12.91</td>
<td>11</td>
</tr>
<tr>
<td>6</td>
<td>Sinnar</td>
<td>2613</td>
<td>5.95</td>
<td>6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>43886</strong></td>
<td></td>
<td><strong>100</strong></td>
<td><strong>118</strong></td>
</tr>
</tbody>
</table>

Source: Command Area Development Corporation, Ahmednagar.

The proposed gross irrigable command area of the left bank canal is 43886 ha. according to the present system. It is observed that, into the figure 3.4 the total irrigated area by LBC is almost one third (74.33%) proposed irrigated area located in Rahata (39.26%) and Sangamner tehsils (35.07%). Remaining about one fourth (25.67%)
irrigation area has contributed in four tehsil namely Kopargaon (12.91%), Sinnar (5.95%), Akole (4.48%), and Shrirampur (2.28%).

**Figure 3.4 Tehsil wise % of Proposed Command of LBC**

The proposed command area of LBC is covered by other existing irrigation systems from various major and medium irrigation projects. In the Northeast side of command area, Godavari right side canal irrigates the Kopargaon, Rahata and Shrirampur tehsil (Figure 3.4). The Godavari right side canal instigates from Nandur Madhmeshwar Major Irrigation project in Nashik district. The southern part of LBC command is delimited by Pravara river up to Ozar ketiweir which is 87 km. below from the Bhandardara major Irrigation Project in Akole tehsil. Apart from Ozar ketiweir, Pravara left bank canal command area feeds Sangamner, Rahata, Shrirampur and Newasa tehsils part. The Northeast part of LBC command is encircled by the two medium irrigation projects. From west Adhala Medium irrigation project and the east side, Bhojapur Medium irrigation projects are located. The Adhala irrigation canal provides irrigation facilities to Akole and Sangamner tehsils while the Bhojapur irrigation canal supplies to Sinnar and Sangamner tehsil area. Figure 3.5 shows the command area of the left bank canal of Nilwande dam and surrounded irrigation canal systems.
Figure 3.5: Command Area of Left Bank Canal of Nilwande Dam

Legend:

- Command Area

Source: Godavari Marathwada Irrigation Development Corporation, Aurangabad

0 4 8 Km

- Malungi River Command Area
- Godavari Right Canal Command Area
- Adhula River Command Area
- Nilwande Left Canal Area
- Pravara River Left Canal Area
- Nilwande Dam
- Pravara River
3.6 Domestic Water Use of Canal

Drinking water is the first priority of any project, according to the water policy of India (2000). Nilwande project is the major irrigation project to fulfill the irrigation facilities in the command area. At present there is only one drinking water pipeline for Sangamner city from the dam. This underground pipeline based on gravity force from the dam to Sangamner city. The sill outlet level of this pipeline is 601m. This was built at the time of the construction the wall of dam. The planner projected next 50 years population growth of Sangamner city and prepared the size and plan of pipeline. The pipeline receives water from the dam up to 630m water level by gravity, in summer season, dam water level decreases below 630m so a separate provision of sub well and pumping house has been created for lifting water from the well and supply to the pipeline. For water filtration 22 million liters capacity of water purification plant is constructed in Nilwande village. The total length of drinking water pipeline is 36.90 km. with 711 mm diameter iron pipeline.

3.7 Resume

This chapter emphasizes on the Nilwande dam, catchment, and command area of the project which helps to understand the present situation of the command area. The catchment of dam is divided into Bhandardara catchment (121.74 Sq. Km) and free catchment (202.21 Sq. Km). The command area of projects is also discussed in the chapter. Tehsil wise proposed irrigation area and their percentage of the total has shown in this chapter. Within that Rahata and Sangamner tehsil cover about 75% command and remaining four tehsils cover about 25% command area. The chapter deals with existing other canal systems in the study area i.e. the Pravara left canal, Godavari right canal, Nilwande high level canal, Adhala canal and Bhojapur Canal. The converse about Sangamner domestic water pipeline system discussed at last. The left bank canal of Nilwande dam is a main focus point in this study. It is necessary to understand the present scenario of the left bank canal with respect to canal features, land use, cropping pattern as well as the water need in various sectors in command area. Therefore, the next chapter further explores water need in the left bank canal command area.