CHAPTER- III

ROLE OF IRRIGATION IN AGRICULTURAL DEVELOPMENT
ROLE OF IRRIGATION IN AGRICULTURAL DEVELOPMENT

Agriculture has held a dominant position in the country's economy. But this major occupation is rendered hazardous by scanty rainfall in large areas and by erratic monsoon elsewhere partial failure or even delayed arrival of the monsoon can cause extensive damage to crops. Conscious efforts are, therefore, being made continuously to supplement rainfall and to mitigate the grave consequences of dry spell by supplying water artificially to parched lands. Irrigation implies maintaining the storage of water in the soil required for plant growth at times and places of deficient water supply.

Different system of irrigation are complimentary and supplementary rather than competitive as has been rightly observed by the Famine Inquiry Commission. "The problem of water supply will not be solved by more extended application one particular method of irrigation but by the use of all the methods. Irrigation comprises of three different aspects, viz. Engineering agricultural and economic and social. Under engineering aspects are included the designing and construction of structures required for storage, diversion, conveyance, delivery and distribution through channels and distributaries determination of water yields of rivers and water supplies for irrigated lands. The agricultural aspects refer to the use of irrigation water and various agricultural practices, and cropping patterns methods of application and the quantity of water and for single irrigation. The socio-economic aspect refers to the satisfaction of social needs and desires is essential for any community enterprises.

1. Two American Scientists from Geological Survey of USA estimated that there are tremendous potentials of ground water in the Upper Gangetic Plain, U.P. and Bihar passes and underground lake which is probably the largest and potentially the most productive in the world.
The rainfall over the country is unequal, irregular and quite often liable to complete failure. With such a wide difference in rainfall between one part and another (such as 1270 cms at Cherapunji and only 25 cms in western Rajasthan), famines have occurred several times in the past. The areas generally affected by variations in the rainfall are those which receive a rainfall of 127 cms and less per annum. Whenever rain fails, i.e., when it is less than 80 per cent of the average, or when it does not occur at the proper crop season, production falls. If deficiency of rainfall is 40 per cent or more famines result and crops do not even grow. To banish famines, that only remedy is artificial supply of water to the lands through irrigation. Sone Canal command area and the Krishna and Godavari Deltas, which are today the granaries of rice, used to be famine-ridden a few years back. Irrigation is the antidote to famine.

**Need of Irrigation:**

Irrigation is deemed necessary for the maximum production of most farm crops, especially in the arid and semi-arid regions. Even in the areas of high rainfall, irrigation of second and third crop or for multiple cropping when rainfall fails. According to the I.C.A.R., the production of irrigated crops is on an average 50 to 100 per cent higher than that of the unirrigated crops in the same locality. In India the growing population demands higher quantities of food grains for its consumption, but in the absence of which imports ranging from 150 to 200 crores of rupees per annum have to be made. To cut short imports, self-sufficiency in food grains is very necessary. This can be achieved, besides putting various inputs in the fields, through increasing irrigation facilities. In fact, among the measures that may be adopted for increasing
area under cultivation and the yield of crops, the first place is must be given to the works for the supply and conversation of water.  

At present 20 per cent of the cropped area of the country is under cash crops, which require produces 30 per cent of the country’s production commanding 33.3 per cent of the total value of Agricultural products. Only about 12 per cent area under cash crops is as irrigated at present. As is known, cash crops ensure employment through industries, and about 60 per cent of the annual Foreign exchange earns come from these products (peppers, spices, tobacco, cashewnuts, cotton, jute and oil seeds and etc). Therefore their productivity can be stopped up through provision of increased facilities. with regard to cereals, where the mean percentage variation in production from year is large, improvement in irrigation facilities leads to higher yields.

Water requirements are of crop depend primarily on climatic and soil factors. Crop season in India is predominantly Kharif followed by Rabi the area under cultivation during the hot weather is very small eing less than 5 per cent. During the Kharif, the mansoon needs a substansial part of water requirements of crops with in the limits some extra moisture stress does not seriously affect yield. Deep rooted crops can tolerate longer dry spells than the shallow rooted ones. Similarly, hot weather crops use up water at a faster rate then Rabi and Kharif crops because of the higher rate of evapo-transpiration in summer.

Different crops require different quantities of water supply through out their growing period. For example, grain crops require their maximum supply during the time ear heads are formed, while sugarcane, cotton, chilies, require more water. Most annual crops do not require water when they are maturing.

The total water requirements of crops varies from 10.6 acre inches for mustard, to 95.0 acre inches for sugarcane. The water needs of other crops are: linseed 12.7 acre inches; barley 14.1; oats 14.4; wheat 14.8; maize 17.8; jowar 25.7; ground nut 26.1; potato 26.7; rag 29.8; chilies 38.8; tobacco 39.2; rice, 41.7; and cotton acre inches.

In addition to the above crops, the water requirements of deciduous fruit trees is about 30 inches; and of circuit and evergreen trees, about 40 inches a year. Touch crops such as beans, lettuce, and water melons require about 16 inches of water, common feeder grasses about 24 inches, and perennial legumes such as lucerne, berseem and clover about 36 inches of water per year. When the required quantity is not available through natural water supply, irrigation has to be resorted to. Considerable advantages of the soil, sunshine and climate, crop production India is not so efficient as in the soil, sunshine and climate crop production in India is not so efficient as in other parts of the soils. Sandy soils require frequent water than the alluvial or black soils. In dry season, enough

3. Ibid., P. 16
residual moisture is not available in the soil to support multiple cropping. It cannot be over-emphasized than to state that “a sadder commentary on our economic situation cannot be found than the close, direct correspondence between harvests depends primarily upon the adequate supply of water”.

The total land area in the country under food crops is 118 m. hectares. There are 52.60 m. hectares in the Indo-Gangetic Plain (i.e. six states of Punjab, Haryana, Rajasthan, U.P. Bihar and West Bengal). In Central India (i.e. Gujarat, M.P., Maharashtra and Orissa), the sown area for foodgrains is 38.4 n. m. hectares; while in Peninsular India (Kerala, Karnataka, Andhra Pradesh, and Tamil Nadu), the food crops are grown on 22.6 m. hectares. The productivity differs considerably from zone to zone and from State to State. While in Punjab and Tamil Nadu, a hectare yields as much as 800 to 1000 kg., in M.P. or in Karnataka the average yield of food crops is 500 kg per hectare. This disparity in food production is entirely due to differences in availability of water for the land either through rain or artificial supplies.

Many of the Indian rivers are not perennial and carry insignificant flows in the rabi season. Besides, there is a wide disparity in water flow from year to year too. In

the case of snowfed rivers in the north, the flows are normally perennial. But the variation between the winter and the monsoon flows may be as much as much as 1 to 100 or more in small hill streams. The characteristic of central and southern rivers is that about 80 to 90 per cent of annual run-off large storage capacities are needed. Through conservation of surface of water parched lands may be watered round the year so that multiple crops can be grown the year round.

India has vast ground-water reserves specially in the Gangetic plain, Narmada basin and deltaic areas, that is in about 40 per cent of our’s country ‘s sown area.11. "According to Dr. G. C. Chatterjee G.S.I) that average annual rainfall in India is 3x10^{12} m^3, about 801+ (10^9 m^3 of water seeps down annually in the soil, only 370x10^9 m^3 of water percolates down to replenish the ground water body. Therefore, large scope exists for the development of these underground water resources

India’s total geographical area of 328 m hectares lies in topical and subtropical zones. The total culturable area is 256m. Hectares and the net sown area in 1974-75 were 138m. Hectares and gross cropped area was 164.m. hectares. Development of irrigation has thus a very important role to play in the growth of Indian agriculture, especially in unirrigated and dry areas.

5. Report of the Royal Commission on Agriculture P.268
Lastly, in good rainfall areas (like Assam, W. Bengal, Orissa, Andhra Pradesh, Tamil Nadu and Kerala) irrigation is required mostly as a supplemental need to protect their single crop agriculture against occasional drought. In Karnataka, Maharashtra, Gujarat, and Bihar too the predominant crops receiving irrigation benefits are that of paddy and to a lesser degree that of sugarcane, percentage of other irrigated crops being comparatively small. It is only in Punjab, Haryana, Rajasthan, M. P., Gujarat and north-western U.P. where irrigation is used extensively for other seasonal crops as well. Development of adequate and dependable irrigation facility is therefore, very essential to banish famines as a result of drought conditions. Irrigation alone supplies dependable and timely supplies of water. In the absence of irrigation, the farmer cannot risk his investment in other inputs which contribute to increased productivity. Thus, irrigation has necessarily crucial role to play in the country’s agricultural production strategy.

DEVELOPMENT OF IRRIGATION

Irrigation in India has been practiced from ancient times and irrigation tanks and wells is a familiar feature of the Indian landscape to supplement and conserve the rainfall. Provision of water for the cultivation had figured prominently among the duties enjoined on the rulers of the land, who undertook the construction of irrigation works as benevolent works and many of the munificence of kings and philanthropists.

ANCIENT INDIA: Ancient Indian civilization mostly developed in the river valleys which were well equipped with irrigation system, which helped in the growth of food crops and cotton. Vedas refer to avata or water wells. Kulya or canal, and sarsi or dam indicating the fact that devices for irrigating land were already known.
Manu mention tanks or artificial storage. Kautilys observed, "If privately managed dams are neglected for 5 years, their charge is taken over by the state. If they are construed only by public contribution, revenue is to be remitted for 5 years. If only repairs are carried out by public effort revenue to be remitted for 4 years." Classical literature is replete with water courses - Pranadi, Kulya, Nala, Naliha tilmaha, etc.

Artificial lakes and canals that dot the country in hundred are centuries old, and some of them have served for more than a thousand years. Megasthenes (4th century B.C.) mentions that the whole country is under irrigation and very prosperous because of the double harvests which they were able to reap each year because of irrigation.

The first structure, a weir built in stone and clay, was probably laid in the 2nd century A.D. This Grand Anicut was built across the Cauvery, about 330-m long, 12 to 18 m. high a wide and 4.62 to 5.5 m. high. The anicut has serviced irrigation and withstood the annual Cauvery floods for more than 1600 years. " It was later remodeled by the Britishers in the 19th century.

**DURING THE MUGHAL PERIOD:** Irrigation development received great attention during the Pre-Mughal and the Mughal periods. The western Jamuna Canal (of Firoze Shah Tughlak) brought water to Delhi in the 14th century. It served as an irrigation canal in the tract it traversed. The Bari-Doab canal was executed by Ali Mardan Khan in the middle of the 17th century. The Eastern Jamuna canal was laid down in the region of Mohammed Shah during the middle of 18th century.
DURING THE BRITISH PERIOD: The British inherited a tradition of irrigation in India. The Indian Irrigation Commission of 1901-03 recorded, "Be this as it may, it is certain that it was the existence of the Grand Anicut in Madras, and the remains of old Mohammedan channels in the Punjab and United Provinces, which suggested and led to the construction of the earliest works carried on under British rule, India, therefore, in a great measure owes to her former rulers the first inception of the present unrivalled system of irrigation works."

Initially during the British Period, Western Jamuna and Eastern Jamuna canals were renovated and remodelled followed by the construction of the Cauvery of the delta system in conjunction with the Grand Anicut. A masonry weir across the coleroon was constructed in 1836. The Upper Ganga Canal was commenced in 1842 and completed in 1854 by P. Coutley. This was followed by other canals like the Lower Ganga, the Agra and the Betwa canals in U.P., the Sirhind canal in Panjab. Other notable works were the weirs across the river Godavari near Rajmahendry, and across the river Krishna near Vijayawada. Along with their canal systems they led to the irrigation of the fertile Godavary, Krishna deltas. Occurrence of very serious famines towards the later part of the 19th century led to the development of irrigation Commission in 1901 to report on irrigation projects, and led to a number of projects like the Triple Canal Project in the Punjab, the Godavari canal in Bombay and the Tribeni canal in Bihar.

Further works were taken up after the First World war, notable example being the Mettur, Nizamsagar, and Krishna Raja-Sagar project, the Periyar canal, the
Khadakvasla storage dam, Pravara and Nira canal in the South and the Ganga Canal and the Sarda canal in the north. Besides these major systems, a large number of medium and small irrigation works like tanks and canals were also constructed all over the country. This led to substantial increase in irrigation and food production.

**PRE-INDEPENDENCE PERIOD:** During depression of 1930's and the Second World War, little development took place in the field of irrigation. The partition of the country resulted in major irrigated areas going to Pakistan. Partition resulted in a substantial reduction in the proportion of irrigated area to 20 percent of the cultivated area. On the eve of independence there were 22.6-m. hectares receiving irrigation, which constituted 24 percent of the net cultivated area in undivided India. Of the total volume of water carried by the canals in undivided India the canals in Pakistan received 81,400-m. cu. M. of water against 11,000 m. cu. M of water used by India in the Indus basin. In terms of irrigated area about 8 m hectares of land went to the share of Pakistan, against only about 2 m. hectares left in India. This further necessitated the growth of irrigation potential.

**PROGRESS OF IRRIGATION**

It would be of interest to know that the irrigated area increased from about less than a million hectares in 1800 to about 5 m. hectares in 1900 and 17 m. hectares in 1925. At the beginning of the Plan period (1951), the area under irrigation was of the order of 22.6 m. hectares. If the water resources could be put to proper use, irrigation facilities can be brought to nearly 82 m. hectares. At the end of 1969-70, about 37.68 m hectares of land was irrigated by 1973-74, 44.1 m hectares was irrigated and by 1976-77, the total irrigated area rose to 47.0 million hectares. Upto 1951, 9.7 m
hectares by minor irrigation works. In addition, 6.5 m hectares were being irrigated by ground water use. At the beginning of the Fourth Plan, it was estimated that about 24 m hectares was under irrigation, 16.9 m hectares under major and medium, and 7.1 m hectares under minor irrigation schemes. Minor irrigation using ground water increased to 12.0 hectares during the same period.

Up to 1951, 9.7 million hectares of land was irrigated by major and medium projects, which existed before independence, like the Upper and Lower Ganges Canal and the Agra Canal in U.P., the Upper Bari Doad and the Sirhing Canal in the Punjab; the Godavari and Krishna System in Andhra; the Cauvery in Madras; Mutha Canals in Maharashtra and Mahandi Canals in Orissa etc.

Up to 1966, an irrigation potential of 7.3 m., hectares was created by various major and medium irrigation projects. This achievement during 1951-1966, was 75 percent of the achievement during the preceeding 100 years. A number of mammoth project were undertaken and completed such as the Bhakra pojct in the Punjab, the D.V.C. in Bihar and West Bengal, Hirakud in Orissa, Matatila in U.P., the Tungabhadra in Mysore and Andhra, he Kosi in Bihar, the Malamphuza in kerala, Nagrjuna Sagar, Purna, Bhadra, Chambal, Rajasthan Canal. Kangsabati. Prambikulam Aliyar, and Mahanandi delta canals. The following Tables 3.1 and 3.2 gives gross and net irrigated areas in India since 1950-51.\(^7\)

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\(^7\) Agriculture in Brief 1916.
Table 3.1

NET IRRIGATED AREA

<table>
<thead>
<tr>
<th>Year</th>
<th>Net sown area Million hectare</th>
<th>Net Irrigated area Million Hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>118.7</td>
<td>20.8</td>
</tr>
<tr>
<td>1960-61</td>
<td>133.2</td>
<td>24.7</td>
</tr>
<tr>
<td>1970-71</td>
<td>140.2</td>
<td>31.2</td>
</tr>
<tr>
<td>1980-81</td>
<td>140.0</td>
<td>38.7</td>
</tr>
<tr>
<td>1990-91</td>
<td>143.0</td>
<td>47.5</td>
</tr>
</tbody>
</table>

Source: Agricultural Statistic at a Glance
At the end of the Sixth Plan, the total irrigation potential, created through major and medium irrigation projects was 40.2 million hectares against the ultimate irrigation potential of 73.5 m. hectares, leaving a potential of 33.5 m., hectares to be created in the future plans.
The following Table indicates the position:

Table 3.3

IRRIGATION POTENTIAL AND UTILISATION

<table>
<thead>
<tr>
<th>Source</th>
<th>Ultimate potential</th>
<th>Potential</th>
<th>Utilisation</th>
<th>Potential</th>
<th>Utilisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Major and medium</td>
<td>58.5</td>
<td>9.7</td>
<td>9.7</td>
<td>31.8</td>
<td>27.2</td>
</tr>
<tr>
<td>2. Minor</td>
<td>65.0</td>
<td>12.9</td>
<td>12.9</td>
<td>53.2</td>
<td>49.1</td>
</tr>
<tr>
<td>3. Total</td>
<td>113.0</td>
<td>22.6</td>
<td>22.6</td>
<td>85.0</td>
<td>76.3</td>
</tr>
</tbody>
</table>

Source: Seventh and Eighth Five year Plan.

According to the Planning Commission, "Irrigation potential created by a project at a given time, during or after its construction is the aggregate gross area that can be irrigated annually by the quantity of water that could be made available, by all connected and competed works up to the end of water course, or the last point in the water delivery system\(^8\). On other hand, "The irrigation potential utilised" is the total gross area actually irrigated by a project during the year under construction\(^9\). The Plan-wise progress of irrigation potential created and its utilization, from major and minor irrigation scheme is given in the Table.

The findings of the Committee of Ministers (1973) are that under utilisation is caused by inadequate planning of the project or inadequate provision of one or more

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of the essential ingredients for irrigated agriculture. Excessive use of wastage of water and inefficient distribution system are also responsible for it. Other causes, according to this Committee for the lag in utilization are:

(i) Construction of field channels not keeping pace with water availability facility.

(ii) Inadequate drainage facilities which hamper the development if irrigation.

(iii) Inadequate preparation of land for irrigated agriculture like land leveling, shaping, etc.

(iv) Slow progress in the matter of consolidation of land holding

(v) Anticipated crop pattern and water allowances under the projects not being utilised.

(vi) Lack of adequate agricultural experimental and demonstration farms and training and extension facilities.

(vii) Mal-distribution of available supplies and absence of a roster system for equitable supply of water to the farms.

(viii) Lack of inputs and infra-structure facilities.

(ix) Neglect of proper operation and maintenance of the irrigation and drainage systems.

Expenditure on major and medium projects has been of the progressive order, as would be clear from the following Table10.

10. Seventh Five Year Plan.
Table 3.4

PROGRESS OF MAJOR AND MEDIUM IRRIGATION

<table>
<thead>
<tr>
<th>Period</th>
<th>Outlay Rs. In Crores</th>
<th>*irrigation Potential M.Hect</th>
<th>Utilisation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Plan Benefit</td>
<td>-</td>
<td>9.7</td>
<td>9.7</td>
</tr>
<tr>
<td>First Plan</td>
<td>380.0</td>
<td>12.2</td>
<td>11.0</td>
</tr>
<tr>
<td>Second Plan</td>
<td>380.0</td>
<td>14.3</td>
<td>13.3</td>
</tr>
<tr>
<td>Third Plan</td>
<td>581.0</td>
<td>16.6</td>
<td>15.2</td>
</tr>
<tr>
<td>Annual Plans</td>
<td>434.0</td>
<td>18.1</td>
<td>16.8</td>
</tr>
<tr>
<td>Fourth Plan</td>
<td>1237.0</td>
<td>20.7</td>
<td>18.7</td>
</tr>
<tr>
<td>Fifth Plan</td>
<td>2442.6</td>
<td>24.7</td>
<td>21.2</td>
</tr>
<tr>
<td>Annual Plan (1978-80)</td>
<td>2056.0</td>
<td>26.6</td>
<td>22.7</td>
</tr>
<tr>
<td>Sixth Plan</td>
<td>7516.0</td>
<td>30.1</td>
<td>25.3</td>
</tr>
<tr>
<td>Seventh Plan</td>
<td>11107.0</td>
<td>31.5</td>
<td>27.8</td>
</tr>
</tbody>
</table>

Source: Eighth Five-year Plan, vol. II

*These are commutative figures.

Out of the total irrigation potential of 6.2 m. hectares to be created during the Fifth Plan continuing schemes (75 major and 155 medium schemes) account for 5.5 hectares and 0.7 m., hectares will become available from new schemes (109 major and 313 medium schemes). The utilisation is expected to be about 5.2 million hectares. The strategy under the Fifth plan was: (i) to achieve a substantial increase in the creation of irrigation potential consistent with the relevant organisational and financial capabilities and having regard to the needs of the drought prone areas; and (ii) improvement in the utilisation of the created potential and efficient management of water and land for achieving maximum productivity. On-going projects will be completed on which construction work has progressed sufficiently. Some new schemes will have to be taken up to maintain the tempo of irrigation development in the Sixth Plan.

During the Sixth Five year Plan the area under irrigation increased at the rate of 0.7 million hectare per year during the First plan period and the growth rate accelerated to 1.6 million hectares and 2.2 million hectares per year during the Fifth and Sixth plan period respectively. An additional irrigation potential of 11.30 million hectare was created during the Sixth Plan period by investing about Rs.8000 crores for major, medium and minor irrigation projects. During the Seventh Plan more emphasis will be placed on the development of minor irrigation works and utilisation of capacity created during the previous plans. For this purpose adequate survey will be undertaken for ground water exploitation; conjunctive use of ground and surface water, renovation of tanks and extension support. For accelerating the tempo of irrigation development a target creation of additional potential of 4.30 million hectares is proposed in the Seventh Plan. The area under irrigation is proposed to be increased at the rate 2.5 million hectares per year in the Seventh Five year Plan.

SOURCE OF IRRIGATION

It may be noted that the systems of irrigation developed in different parts of the country is governed by local, meteorological, geological and other physical conditions. Therefore, there cannot be any uniformity in the system of irrigation in different tracts. Alluvial tracts in the Gangetic and coastal plains is especially suited for canals and wells: in crystalline areas of the Deccan plateau irrigation from tanks is most extensive and in the northern parts and black cotton tracts of Deccan, submontane regions of the eastern and western sides of the Western Ghats and the Punjab, a considerable proportion of land is irrigated by wells.
Of the area irrigated, more than half depends for its irrigation supplies on minor works. Rest of the area is irrigated from river canals. Their distributaries and channels, all of which are included under medium and major irrigation works. The following Table 3.5 shows different sources of irrigation available in India. The Table shows that area irrigated by Government canal and tubewells has increased considerably.

Table 3.5

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Canal</td>
<td>7.2</td>
<td>9.2</td>
<td>12.0</td>
<td>14.5</td>
<td>15.0</td>
</tr>
<tr>
<td>Private Canal</td>
<td>1.1</td>
<td>1.2</td>
<td>0.9</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Tanks</td>
<td>3.6</td>
<td>4.7</td>
<td>4.1</td>
<td>3.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Well and Tube wells</td>
<td>5.8</td>
<td>7.2</td>
<td>11.9</td>
<td>17.7</td>
<td>21.8</td>
</tr>
<tr>
<td>Other Sources</td>
<td>3.0</td>
<td>2.4</td>
<td>2.3</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>Total Net Irrigated Area</td>
<td>20.8</td>
<td>24.6</td>
<td>31.1</td>
<td>38.8</td>
<td>43.0</td>
</tr>
</tbody>
</table>

Source: Statistical Outline of India
Table: 3.6

AREA IRRIGATED BY SOURCES (PERCENTAGE)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Government Canal</td>
<td>34.3</td>
<td>37.2</td>
<td>38.5</td>
<td>37.4</td>
<td>34.8</td>
</tr>
<tr>
<td>Private Canal</td>
<td>5.5v</td>
<td>4.9</td>
<td>2.9</td>
<td>2.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Tanks</td>
<td>17.3</td>
<td>18.5</td>
<td>13.2</td>
<td>8.3</td>
<td>6.5</td>
</tr>
<tr>
<td>Well and Tube wells</td>
<td>28.7</td>
<td>29.7</td>
<td>38.1</td>
<td>45.5</td>
<td>50.7</td>
</tr>
<tr>
<td>Other Sources</td>
<td>14.2</td>
<td>9.8</td>
<td>7.3</td>
<td>6.7</td>
<td>6.9</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Source: Statistical Outline of India.

From the above Table 3.6 shows that, it may be inferred that the area irrigated is served by canals, tanks, wells and other sources. The largest source of irrigation is canals, providing 40.9 percent of the water to the total irrigated land. This is closely followed by wells, with 40.8 percent. Tanks supply a comparatively small proportion (11.3 percent). Other sources are of minor importance, with only 7.0 percent. The percentage from these sources, over the years, has been as follows:

Taking the crop-wise use of water supply, the following Table would reveal that they are in diminishing percentage, in heat being highly irrigated followed by barley and rice. Others in importance are pulses, sugarcane, cotton, oilseeds and fruits and vegetables.
Table: 3.7

IRRIGATED AREA TO TOTAL AREA UNDER THE CROP
(Percentage)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>38.4</td>
<td>40.5</td>
<td>44.8</td>
<td>46.0</td>
</tr>
<tr>
<td>Jowar</td>
<td>3.7</td>
<td>3.8</td>
<td>6.1</td>
<td>6.4</td>
</tr>
<tr>
<td>Bajra</td>
<td>4.0</td>
<td>5.4</td>
<td>5.2</td>
<td>6.2</td>
</tr>
<tr>
<td>Maize</td>
<td>15.9</td>
<td>19.7</td>
<td>19.7</td>
<td>22.3</td>
</tr>
<tr>
<td>Wheat</td>
<td>54.3</td>
<td>69.7</td>
<td>80.9</td>
<td>82.9</td>
</tr>
<tr>
<td>Barley</td>
<td>52.0</td>
<td>50.4</td>
<td>54.6</td>
<td>60.2</td>
</tr>
<tr>
<td>Pulse</td>
<td>8.8</td>
<td>8.9</td>
<td>10.2</td>
<td>10.8</td>
</tr>
<tr>
<td>Total food grains</td>
<td>24.1</td>
<td>29.4</td>
<td>34.7</td>
<td>36.7</td>
</tr>
<tr>
<td>Oilseeds</td>
<td>7.4</td>
<td>14.3</td>
<td>22.1</td>
<td>23.9</td>
</tr>
<tr>
<td>Cotton</td>
<td>17.3</td>
<td>27.1</td>
<td>32.8</td>
<td>33.1</td>
</tr>
<tr>
<td>Sugarcane</td>
<td>72.4</td>
<td>80.8</td>
<td>86.2</td>
<td>83.5</td>
</tr>
</tbody>
</table>

Economic survey 1994-95 shows that wheat being highly irrigated followed by barely and rice. About 83 percent of the total area under crop is irrigated.

MAJOR AND MEDIUM IRRIGATION WORKS

During 1950-51 and 1973-74, 97 major and 513 medium irrigation schemes were taken up. Of these 22 major and 358 medium schemes were completed and the rest spilled over to the Fifth Plan. During Fifth Plan, 64, out of 75 major and all the 155 medium schemes will be completed. Besides work will be initiated on 109 major and 313 medium irrigation schemes. The total investment on major and medium irrigation projects between 1951-52 to 1976-77 was Rs.4595 Crores, and that for Fifth Plan being Rs.3,135 crores. The outlay for 1977-78 is Rs.989 Crores.12

The importance of major and medium irrigation works lies in the conservation of the surplus and floodwaters. Mere concentration on minor irrigation schemes would lead to a great waste of total usable water that is yet untapped. Only major and medium projects can be utilised as Multi-purpose Projects which may serve not only the purpose of irrigation but also that of water power generation, supply of domestic water, navigation, fish culture and recreation facilities.

But major and medium irrigation projects, at the same time, suffer from certain drawbacks. A large number of pre-requisites are needed for their successful implementation. Firstly, they need a vast amount of capital expenditure for purchase of land, construction of dam, surface storage and provision of distribution channels and require money for resettlement of the ousters from the areas that may be submerged under the dams. Secondly, the loss in distribution system. When distributaries are not lined amount to about 40 percent of the total water left in the channels. Thirdly, a large area might suffer from the problems of water-logging, needing vast amount of money for reclamation purposes. Fourthly, the catchment area of the dam needs protection from soil erosion, otherwise the dam may be silted very soon and go out of use. Fifthly, such schemes involve more time in investigation, planning and construction and the gestation period is even large. Finally they are less reliable for timely supply of water. As a result of all these factors the major and medium irrigation projects can be undertaken by the Government itself.

MINOR IRRIGATION WORKS: - Minor irrigation programmes relate to the development of ground water resources on scientific lines. Such programmes include:
(i) surface water schemes such as small stream diversions; (ii) rain storage tanks in small
catchments, generally located on small streams on tributaries of rivers; (iii) renovation of existing tanks and diversion works; (iv) ground water tapping through construction of open wells, boring of wells for augmenting supplies, deepening of wells in rocky areas by pneumatic blasting, sinking of tube wells of various capacities; lifting of water from the wells through large-scale installation of water pumpsets in place of the old country methods of water lifting such as counter poise lift and rope and bucket lift (v) construction and repair of small drainage channels, embankments for flood protection and head water tanks, percolation tanks ahars, bundhies, for conserving moisture and replenishing groundwater. 13

The minor irrigation schemes have the great advantage in that they yield results promptly. (I) They can be conceived and completed quickly and handled to a large extent by the cultivators themselves (ii) They need small outlay of capital and mostly use local talents and resources. (iii) The utilisation of the irrigation potential is almost immediate (iv) Since these works are owned by the cultivators themselves, they bring major satisfaction of the psychological and the physical needs of the cultivators: (v) Since the cultivators know fully the capacities of these works, water supply from these can be more reliable, so that they may adopt a cropping pattern to suit their needs, (vi) As the utilization to water in these cases is usually confined to the area very near to the sources, loss of water and its distribution is very much reduced. (vii) These are essentially people-centered programmes which provide scope for individual as well as co-operative efforts. (viii) The cost per hectare of minor irrigation is lower than in major irrigation. Tubewells as a major component of minor irrigation schemes are an important method for providing water for minor irrigation.

irrigation are far more reliable than storage schemes. (ix) Ground water has the great advantage in that it is doubtful and can be freely stored and freely move underground so that the loss by evaporation and seepage both during storage as well as during conveyance. (x) Minor irrigation system does not require a large army of men to maintain and operate it.\(^{14}\)

It is of interest to note that though in certain areas, major and medium irrigation schemes may be more feasible, there are others where minor irrigation schemes would be more beneficial such as in the contiguous patches of cultivated land available in undulating areas and rocky terrain, and are generally small. There are yet other areas where major, medium and minor schemes have to play a complementary role to perform. Thus, as areas allocated to High Yielding Varieties of seeds minor irrigation schemes have been accepted as complementary to major schemes. It is for this reason that emphasis has been, under the Fourth Plan, to develop minor irrigation schemes.

However, minor irrigation schemes do suffer from certain defects: (I) Except diversion schemes, all minor irrigation schemes have a certain span of life. Tanks gradually lose their irrigation capacity as a result of silting (ii) The discharge of tube-wells generally reduce as a result of gradual deterioration of strains (iii) Mechanical appliances have any to be replaced after 10 to 20 years (iv) It is difficult to have any precise assessment of the area lost by depreciation (v) The surface storage schemes, if they are located in high areas tend to be unreliable if rainfall.

\(^{14}\) P.V. Shenoi, op.cit., P. 175.
PROGRESS OF MINOR IRRIGATION SCHEMES:— There were about 5 million open wells and only 3000 to 4000 tube wells in the country at the beginning of the First Plan, since then phenomenal progress has taken place.

The number of wells increased from 3.64 million in 1956 to 5.11 million in 1966 and further to 6.10 million in 1971. Easy credit from institutional sources, expansion of rural electrification and profitability of forming as a result of the introduction of high yielding varieties, encouragement of multiple cropping and an incentive oriented price policy were the main contributory factors.

In March 1969, there were 261,000 irrigation tube-wells in the country, including 15,000 State tube-wells. Most of the tube-wells are privately owned. The deep tube-wells, because of the high cost involved, are best undertaken by the state, while shallow ones are owned by private persons. The number of shallow tube-wells went up from 245,000 in 1968-69 to 782,000 in 1973-74. The number of pump sets (both electric and diesel operated) is estimated to have gone up from 16.1 lakhs in 1968-69 to 41.3 lakhs tube-wells were constructed and 4 lakhs diesel pump sets and 2.6 lakh electric pump sets were installed, benefiting an area of about 17 lakh hectares.

The area irrigated by the minor schemes prior to planning 12.9 million hectares. The cumulative achievement of potential under this programme by the end of 1984-85 was 37.4 million hectares which includes an addition to potential under this programme by the end of 1984-85 was 37.4 million hectares which includes an addition to potential

of 7.4 million hectares created during the Sixth Plan. The ultimate potential for development of minor irrigation has been assessed at 55 million hectares comprising 15 hectares from surface water and 40 million hectare from ground water. The area irrigated by minor irrigation in 1984-85 was 35.1 million hectare against the potential created 37.4 million hectare by 1984-85. Following Table shows the progress of creation of irrigation potential in minor irrigation.

Table: 3.8

### PROGRESS OF MINOR IRRIGATION

<table>
<thead>
<tr>
<th></th>
<th>Out lay (Rs.in Crores)</th>
<th>Potential Million Hectare Commutative</th>
<th>Utilisation Million hectare Commutative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-Plan</td>
<td>-</td>
<td>12.9</td>
<td>12.9</td>
</tr>
<tr>
<td>First Plan</td>
<td>66.0</td>
<td>14.1</td>
<td>14.1</td>
</tr>
<tr>
<td>Second Plan</td>
<td>161.1</td>
<td>14.8</td>
<td>14.8</td>
</tr>
<tr>
<td>Third Plan</td>
<td>443.3</td>
<td>17.0</td>
<td>17.0</td>
</tr>
<tr>
<td>1966-99</td>
<td>560.4</td>
<td>19.0</td>
<td>19.0</td>
</tr>
<tr>
<td>Fourth Plan</td>
<td>1174.1</td>
<td>23.5</td>
<td>23.5</td>
</tr>
<tr>
<td>Fifth Plan</td>
<td>1411.2</td>
<td>27.3</td>
<td>27.3</td>
</tr>
<tr>
<td>1978-80</td>
<td>987.4</td>
<td>30.0</td>
<td>30.0</td>
</tr>
<tr>
<td>Sixth Plan</td>
<td>3239.5</td>
<td>35.2</td>
<td>35.2</td>
</tr>
<tr>
<td>Seventh Plan</td>
<td>6426.9</td>
<td>43.1</td>
<td>43.1</td>
</tr>
</tbody>
</table>

Source: Eighth Five year Plan.

**MODERNISING IRRIGATION: -** The National Commission on Agriculture has assessed the irrigation Potential from all sources, at about 93 million hectares which is only about half the total crop area with full harnessing of the water resource only about one-fourth of the cropped area would be irrigated. Hence, maximum benefits need be derived from the irrigational schemes. The Irrigation Commission has also felt the need for improving the Irrigation system in order to increase their efficiency and usefulness. It has pointed out that “in the run-off the river schemes, which derive there supply of water soley from diversion works on river,
shortages are experienced during the low stage of river flows which occur in summer in the peninsular rivers and in winter in the plain area rivers. The earlier irrigation systems of North India were designed with low intensities and cultivators given a share of water proportionate to their holding in the commanded areas. They have naturally been applying water thinly to irrigate as much area as possible. Thus, mode of irrigation is not conducive to high yields particularly from high yielding varieties.

DEVELOPMENT OF DRY AREAS

INTEGRATED DEVELOPMENT OF DRY AREAS: - An intensive programme known as Integrated Dry Land Agricultural Development, was launched in 1970-71, initially in pilot projects (in Hyderabad, Rajkot, Hissar, Indore, Sholapur, Bellary, Jodhpur, Tirunelvelly and Jhansi). Later on it was introduced in 15 more pilot projects during 1971-74 in Anantapur, Palamau, Kutch, Mohindergarh, Jammu, Rowa, Akola, Hebbel, Bijapur, Udaipur, Bhilwara, Salem, Ghazipur, Agra and Bhubaneswar. During 1977-78, 24 pilot schemes were in progress. Each project covered an additional area of 800 hectares. The programmes include cultivation of drought resistant, short duration and high yielding varieties of crops with package of practices, land development including land shaping and land leveling, construction of well, bunds and bundies and distribution of improved farm machinery, seeds, fertilizers and pesticides.

The purpose of this programme has been to develop and extend techniques and undertake measures which are capable of benefiting dry lands. In the country as a whole there are about 128 districts which have low medium rainfall (Between 375 mm. and 1125 mm) annually with limited irrigation facilities. Out of these, 91
districts spread out mainly in A.P., M.P., U.P., Gujarat, Maharashtra, Tamil Nadu, Karnataka and parts of Haryana constitute typical dry land tracts. The total net area sown in these areas is estimated at 42 m hectares, of which, about 5m hectares are irrigated. In this tract, the very high intensity dry farming areas (with rainfall varying 575 mm to 750 mm and irrigated area below 10 per cent of the cropped area) mainly cover central parts of Rajasthan, Saurashtra region of Gujarat and rain shadow region of Western Ghats of Maharashtra and Karnataka. It is these dry land farming areas which hold good promise of Maharashtra and Karnataka. It is these dry land farming areas which hold good promise of responding to a new package of technology.

The development efforts under this programme involve: (i) land consolidation and soil conservation; (ii) improvements in tillage leading to better soil texture and root penetration; (iii) addition of plant nutrients through deep placement of fertilizers. (iv) adoption of water-harvesting procedures resulting in storing as much as of the moisture as possible for the use of crops; (v) Use of improved seeds; (vi) cultivation of draught resistant and short duration crops: (vii) popularization of crops like soyabean, wheat, maize, castor, safflower, sunflower, cotton, cashewnuts, oil palm, dates, grasses; (viii) Popularisation of multiple cropping programmes, and (ix) genetic upgrading of the non-descript cattle population. Besides, a systematic survey and development of ground water resources is undertaken to further increase the income potential of agriculture in dry areas.

The essential pre-requisite is to encourage land leveling, land shaping, water harvesting and soil conservation practices by way of suitable subsidies and loans to farmers with less then 4 hectares holding. The schemes take care of infrastructure requirements like use of improved seeds, implements, foliarspraying of urea and
pesticides, sprinkler irrigation demonstration and suitable animal husbandry programmes.

**DROUGHT-PRONE AREA PROGRAMME (DPAP):** - DPAP was started as an integrated area development programme in 1973 as a long term measure for restoration of ecological balance and optimum utilization of the land, water, livestock and human resources and to mitigate the effects of drought.

**MAIN ELEMENTS OF THE PROGRAMME**

Its main elements are given below:

1. Promotion and management of water resources.
2. Soil and moisture conservation measures and agro-climatic conditions of the area with suitable cropping pattern.
3. Afforestation with special emphasis on social, farm forestry and: Pasture and fodder resource development.
4. Livestock development and dairy development including pasture and fodder resource development.
5. Use of improved seeds and fertilizers.
6. Restriction of cropping pattern and changes in agronomic practices.
7. Cultivation of drought resistant and short-duration crops.
8. Development of subsidiary occupations the drought prone areas are identified on the basis of factors such as

   (a) High frequency of drought
   (b) Low erratic distribution of rainfall
   (c) Inadequate irrigation facilities.
### Table 3.9

**ACHIEVEMENTS OF DPAP**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Programme</th>
<th>1985-90</th>
<th>1990-91</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Expenditure (Rs. Crores)</td>
<td>461.9</td>
<td>93.9</td>
</tr>
<tr>
<td>2</td>
<td>Physical Achievement in Key Sectors(00 hectares)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(a) Land development</td>
<td>4774.8</td>
<td>1430.3</td>
</tr>
<tr>
<td></td>
<td>(b) Water resources</td>
<td>2095.8</td>
<td>215.2</td>
</tr>
<tr>
<td></td>
<td>(c) Forestry</td>
<td>3741.6</td>
<td>700.0</td>
</tr>
</tbody>
</table>

Source: Eighth Five year plan, Vol. 11

The Table given below shows the performance of DPAP during Seventh Five Year Plan and 1990-91. It is clear from the Table that physical achievements of key sectors such as land development, water resources and forestry development are satisfactory.

**DESERT DEVELOPMENT PROGRAMME:** The desert areas of the country are economically poor and deserves concentrated attention for development with this objective Desert Development programme was initiated the 1977-78 on the recommendation of the National Commission on Agriculture. The programme covers the hot desert of Gujarat, Rajasthan and Harayana as well as cold desert areas of Jammu and Kashmir and Himachal Pradesh Desert Development programme is operative in 131 blocks of 21 districts of in 5 states. The programme covers an area of about 3.62 lakh sq. Kms it has been estimated that the programme covers a population of about 150 lakhs.

Since inception (1977-78) till March 1993 an amount of Rs 447 crore and during the seventh plan period Rs 194.07 crore has been spent under this programme.
The following physical achievements have been made under the programme up to March 1993.

Table 3.10
PARTICULARS OF PHYSICAL ACHIEVEMENTS OF DDP

<table>
<thead>
<tr>
<th>Sector</th>
<th>Hectors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land shaping and development soil moisture conservation</td>
<td>1,22,823</td>
</tr>
<tr>
<td>Water resource development</td>
<td>56,202</td>
</tr>
<tr>
<td>Afforestation pasture development</td>
<td>2,29,457</td>
</tr>
</tbody>
</table>


MILLION WELLS SCHEME: During 1988-89 a new scheme known as million wells as a sub scheme of the RLEGP was launched for construction of open irrigation wells for small and marginal farmers belonging to scheduled castes and scheduled Tribes who are below the poverty line under the scheme Rs 110 lakh irrigation wells are expected to be constructed at the cost of Rs 171 crores.

COMMAND AREA DEVELOPMENT PROGRAMME:- This programme seeks to accelerate the process of utilization of irrigation potential and improves the efficiency of utilisation through a multi-disciplinary approach. The ultimate objectives are: (1) securing of maximum yields per unit of water or per unit of land as the case may be, depending on the availability of water, soil and climatological factor in a basin (ii) enabling the farmer not only to secure maximum production but also to get the maximum economic benefit by proper and timely disposal of his produce through adequate facilities like communications markets and processing industries.
Watershed Programme in India

Traditionally, India depended on agriculture and the Indian farmers themselves maintained the watersheds, ponds, tanks and irrigation system for centuries. As noted by Jalswal and Purandare (1995), the farmers and villagers themselves undertook activities such as desiltation of water channels and ponds, protection of vegetative and soil conservation activities collectively under the guidance of village councils. Increase in population pressure and erosion of socio-religious and political institutions degraded the land, water and vegetation.

The need for public effort in watershed development was recognized in India soon after independence. Watershed approach was put to practice for the first time in the country in 1949 by the Damodar Valley Corporation. Major multipurpose irrigation projects launched in India aimed at improvement of mega watersheds. The importance of micro watershed development was recognized and practiced in the country since 1973 due to the recommendations of the Task Force on Integrated Development of Drought Prone Areas. From 1979-80, watershed development was transferred to the State Governments as per the recommendations of the National Development Council.

During the implementation of Watershed Development Programmes, many constraints have come to force. To inquire into these constraints and to suggest suitable remedies, a committee was appointed in 1993 under the leadership of Prof. C.H. Hanumantha Rao. On the basis of the recommendations of this committee, the Technical Committee on DPAP and DDP (1996), the Ministry of Rural Development Programme in the country. The following guidelines of the Watershed programmes in India.
OBJECTIVES OF WATERSHED DEVELOPMENT: - Watershed development programme in India envisages promotion of multiple objectives. They include the following:

1. To promote the economic development of the village community which a directly or indirectly dependent on the watershed through:

   - Optimization of the watershed’s natural resources like and, water, vegetation, etc., that will mitigate the Adverse effects of drought and prevent further Ecological degradation.

   - Employment generation and development of the human and other economic resources of the village in order to promote savings and other income-generation activities.

(ii) To encourage restoration of ecological balance in the village through:

Sustained community action for the operation and maintenance of assets created and further development of the potential of the natural resources in the watershed by promoting simple, easy and affordable technological solutions and institutional arrangements that make use of, and build upon, local technical knowledge and available materials.
(iii) Special emphasis to improve the economic and social condition of the resource-poor and the disadvantaged sections of the Watershed Community such as the asset less and the women through.

- More equitable distribution of the benefits of land and Water resources development and the consequent bio Mass production.

- Greater access to income generating opportunities and Focus on their human resource development.

Selection of District/ Block / Village

The watershed projects are implemented in the districts and the blocks that been notified by Government of India. These districts or blocks are usually selected where already programmes like DPAP, DDP, HADP, etc., are being implemented.

Keeping in view the strategy of people's participation for sustainable watershed development, suitable criteria are laid down for selecting villages. Selection is made of only those villages from where people's participation is assured through voluntary donations / contributions in terms of labour, raw materials, cash, etc for the developmental activities as well as for the operation and maintenance of the assets created. The minimum norms for such contributions are:

- For investments on community works / development of Common property resources such as pasturelands, social forestry, community nurseries, etc on public
or private lands, at least 5%, of the cost of investment shall be contribution from
the community. This may come from the village community/panchayat or users
who are likely to derive benefit from these investments.

- For investments on individual works on private property, at least 10% of the value
of work/investment must come from the beneficiary users. However, in the case
of scheduled castes and scheduled tribes and persons identified as below the
poverty line, the minimum contribution shall be 5%.

- A resolution from the Gram Panchayat to the effect that the village community /
panchayat is willing to take over, operate and maintain the physical assets that will
be created as a part of the watershed development project.

- A resolution from the Gram Panchayat to the effect that the Gram Panchayat in
the case of common property resources like fisheries tanks, common pasture
lands, community forests/wood lots etc., and the watershed community in the case
of other community assets created under the project, shall be willing to share the
benefits from these assets with the weaker sections of society such as Scheduled
Castes, Schedule Tribes, women and other persons below the poverty line in an
equitable manner.

The receipt of contribution from the community/individuals does not mean
that movement's investment on the works/activities would go down to that extent.
Government shall meet the full cost of the works/activities on 100% basis. The public
contributions would be acceptable in the form of free labor or materials. The public
contributions would be acceptable in the form of free labor or materials. Where such contributions are received, a sum equal to the monetary value of the free labor & materials would be taken from the watershed Project Account and deposited in a separate Watershed Development Fund in each village for future operations and maintenance of the assets created after the project is over. Cash contributions in lieu of free labour or materials shall be directly deposited in the WDF. And this Fund shall be operated only by the watershed users themselves. Subject to the above conditions stated, preference is given to the villages in the selection which satisfy the following conditions:

1. Villages where some Voluntary Agency, KRISHI VIGYAN KENDRA or other Government or institutions like Agricultural University Research Stations, Public Undertakings, Cooperatives, Private Sector companies, banks, etc., are working and willing to take on the responsibility of project implementation.

2. Villages that are already organized into homogeneous groups for thrift and credit activity, Development of Women and Children in Rural Areas (DWACRA), social forestry, joint forest management committees, community-based convergence of services (CBCS) group, etc.

3. Villages with a past record of participation in social and community-based campaigns such as literacy campaigns, family welfare, prohibition etc., and

4. Villages where water is allocated on priority basis and other facilities are provided to serve the lands of marginal farmers and women.
SELECTION OF WATERSHEDS

A watershed is a geohydrological unit or an area that drains at a common point. In each selected village, a watershed of approximately 500 hectares is to be identified and selected by the Watershed Development Team in consultation with the Panchayat or Community. The size of the watershed has been fixed keeping an average norm in view. The calculation of the workload and expenses of a PIA have been worked out keeping this factor in mind. However, if it is not be possible to find watersheds of this size, the area can be increased or decreased. The following criteria are used in prioritising the selection of the watershed:

1. Watershed which has acute shortage of drinking water.
2. Watershed which has large population of scheduled castes or Scheduled tribes dependent on it.
3. Watershed which has preponderance of wastelands.
4. Watershed which has a preponderance of common lands.
5. Watershed where actual wages are significantly lower than the minimum wages.
6. Watershed which is contiguous to another watershed which has already been developed or selected for development.
7. Watersheds which had been previously taken up for comprehensive development or treatment works under any of the programmes like DPAP/DDP/NWDPRA/ IWDP shall not be taken up again. However, if the specific area of the watershed identified had not previously benefited from any development works, even though it was a part of a large watershed taken
up under any of the programmes it may be selected for watershed development project.

8. Five hundred hectares is a general norm and if on actual survey, a watershed is found to have slightly less or more area, it may be taken up for development. Even small contiguous watersheds with an approximate total area of 500 hectares may be taken up, and

9. Though a watershed should normally fall within the village boundaries, it may still be taken up for development with the consent of the neighboring village / Panchayat.

ORGANISATIONS FOR IMPLEMENTATION: - The watershed development program is implemented under the overall guidelines formulated by the Ministry of Rural Development at the National level. At the State and District levels, implementation of the programme is carried out jointly by the Government Departments, Non-Government Organisations, Universities & Training Institutions and the people. The organizational pattern of watershed programme at different levels is noted below.

STATE LEVEL ORGANIZATION:

To ensure coordination amongst various Government Departments, Agricultural Universities, Voluntary Agencies and training institutions, a state level Watershed Development Implementation and Review Committee is constituted under the Chairmanship of the Chief Secretary/ Additional Chief Secretary/ Agricultural Commissioner/ Development Commissioner. Secretaries / Heads of Departments of related departments, Vice-chancellors of the State Agricultural Universities, Directors
of a few state level training institutes like SIRD, institute of Administration or Management Institute of Administration or Management Institute, five or six representatives of important Voluntary agencies in the state who are involved in Watershed Development of Rural Development shall be the nodal agency of this committee. The Committee meets at least twice a year to monitor, review and evaluate the progress and implementation of the Watershed Development Programme.

**DISTRICT ORGANIZATION:**

The Zilla Parishad or the DRDA, as the case may be, is responsible for implementation of the Watershed programme at the district level. It approves the Watershed Development plans, selects the Project Implementation Agencies, and receive funds directly from the Government of India / State Governments for Implementing the watershed development programme.

Funds for Implementing the approved watershed development projects will be released by the Zilla Parishads/ DRDAs as the case may be, to the Panchayats / Watershed Development Committees. Besides, the Zilla Parishads/ Watershed Development Committees. Besides, the Zilla Parishads/ DRDAs will exercise necessary administrative and financial control over the Project implementation Agencies, Watershed development Teams and the village level watershed development committees. These functions include release of funds, inspection of works, super check on the maintenance of accounts, inquiring into complaints / allegations against Project Implementation Agencies / Village Panchayats / Watershed development Teams. They shall also prescribe the formats, norms and guidelines for
maintenance of accounts, community organization, campaigns, farmers training, exposure visits, etc.

**WATERSHED DEVELOPMENT ADVISORY COMMITTEE:**

The Zilla Parishad / DRDA, as the case may be, may constitute a Watershed development Advisory Committee under the Chairmanship of the Chief Executive Officer of the Zilla Parishad / Project Director of the DRDA consisting of 3 or 4 members from among its Multi-Disciplinary Team, 5 or 6 representatives of VAs / PIAs which are implementing watershed projects in the district and one or two members from the relevant Research and Training Institutions will advise the Zilla Parishad / DRDA regarding the eligibility of Project Implementation Agencies, members of Watershed Development Teams. It assists the ZP or DRDA in various aspect concerning the watershed development such as planning, training, community organization, publicity campaigns and such other items / activities as may be assigned to it.

**PROJECT IMPLEMENTATION AGENCIES:**

Voluntary Agencies and other Institutions such as Universities, Agricultural Research and Training Institutions, Corporations, Cooperatives, Banks, Public and Private Commercial Organizations, Panchayati Raj Institutions and Government Departments are constituted into the Project Implementation Agencies.

The roles of the Project Implementation Agencies (PIAs) are concerned with planning, coordinating and supervising the formulation and implementation of Watershed Development projects in groups of selected villages. The other roles
include motivation of the Gram Panchayats to pass the necessary resolutions related to public contributions; conduct Participatory Rural Appraisal (PRA) exercises; preparation of the development plans for each watershed; undertake community organization and training for the village communities; provide technical guidance and supervision of watershed development activities; manage project implementation; inspect and authenticate project accounts; undertake action research to adapt low-cost technologies; and monitor and review the overall project implementation. The PIA is also entrusted with the responsibility of setting up the institutional arrangements for post-project operation and maintenance and further development of the assets created during the period.

In the absence of suitable Voluntary Agencies or other institutions, to work as Project implementation Agencies, the ZP / DRDA may act as Project Implementation Agency by constituting Watershed Development Teams same manner as other Project Implementation Agencies. The ZP / DRDA may withdraw from the implementation of the project as soon as a Voluntary Agency is willing to take over the activity.

WATERSHED DEVELOPMENT TEAMS:

The Watershed Development Teams play an important role in promoting the watershed development programme. Each PIA shall carry out its duties through a multi-disciplinary team designated as the Watershed Development Team (WDT). Each WDT may handle 10-12 watershed development projects and may have at least four members – one each from the disciplines of plant sciences, animal sciences, civil / agricultural engineering and social sciences. Minimum qualification would be a professional degree in Agriculture / Horticulture / Veterinary Sciences, Civil or
Agricultural Engineering or Post-Graduation in Botany, Economics / Sociology / Social Work. Those who have practical field experience in the rural areas would be given preference. The senior most amongst them shall be designated as the Project Leader.

The WDT shall work exclusively and full-time for the watershed development projects in the selected villages. The PIA will be at liberty to either earmark its own staff exclusively for this work, or recruit fresh candidates including retired personnel, or take people on deputation from government or other organizations. The establishment charges for the WDT are to be debited to the Watershed Development Projects. A PIA may take several groups of villages by constituting the required number of WDTs. The WDT shall be located at the PIA or block or local headquarters or any other small town whichever is the nearest to the cluster of selected villages.

In the case of a Government Department acting as a Project Implementation Agency, it may constitute Watershed Development Team by taking on deputation officers possessing the requisite professional qualifications. The Department concerned shall be entitled to draw the establishment charges for the Watershed Development Team like any other implementation agency provided the services of the team are exclusively utilized on full-time basis for the Watershed development Project.

The village or project level organization consists of three tiers of organization, viz., the Watershed Association, Watershed Committee and Watershed functionaries.
including the Secretary and Volunteers. In the case of the watershed conterminous with a village Panchayat, the Gram Sabha of the Panchayat concerned will be designated as the Watershed Association. However, when a watershed comprises of areas coming under the jurisdiction of more than one Panchayat, members of the community who are directly or indirectly dependent upon the watershed area will be organized into a Watershed Association. Such Watershed area will be organized into a Watershed Association. Such a Watershed Association should be registered as a society under the Registration of Societies Act. The Watershed Association will meet, at least, twice year to evolve / improve the watershed development plan; monitor and review its progress; resolve differences or disputes between different user groups, self-help groups or amongst its members; approve the arrangements for the collection of public / voluntary donations and contributions from the community and individual members; lay down procedures for the operation and maintenance of assets created; nominate members of the Watershed Committee from amongst the user groups / self-help groups by a system of rotation; and take disciplinary action of removal of membership from the Watershed Committee or user groups and whatever other disciplinary action it deems fit.

The day-to-day activities of the Watershed Development Project shall be carried out by a Watershed Committee. The Watershed Committee may consist of 10-12 members who will be nominated by the Watershed Association from amongst the user groups (4-5), self-help groups (3-4), Gram Panchayat (2-3) and a member of the Watershed Development Team. While making nominations, the Watershed Committee has to provide adequate representation for women, Scheduled castes, Scheduled Tribes, shepherds.
The Watershed Committee will elect a Chairman from amongst its members and perform such functions as are assigned to it by the Watershed Association. The Watershed Committee will be responsible for coordination and liaison with the Gram Panchayat, the Watershed Development Team, the DRDA / ZP and Government Agencies concerned to ensure smooth implementation of the Watershed Development project.

Each Watershed development Project shall have a Watershed Secretary. He will be a full-time paid employee of the Watershed Association. He should preferably be a graduate from the same village or at least from some near by village and he should agree to live in the watershed village during the project period. He will work under the direct supervision of the Chairman of the WC and will be responsible for convening meetings of the WA and the WC and for carrying out all their decisions. He will maintain the all the records and accounts of the WC and WA. He also help the user groups and self-help groups to maintain their accounts. He will be assisted in his responsibilities by three Watershed volunteers form the watershed area village. One of the volunteers may be a woman, another a scheduled caste or scheduled tribe and the third may be from any community. The establishment cost for the Watershed secretary and the Watershed volunteers shall be charged to the administrative overheads of the project and are paid through the WDT.

The funds for watershed development are released by DRDA/ZP partly to the project implementation agency for meeting the administrative, training and
organization purposes and to the watershed committee for the works component. The funds are released in installment annually for four years of the project duration.

The funds given to watershed committee are to be used exclusively for the works component. The allocations of 25 percent finance to PIA is meant for administration (10%), Training (5%), Community Organisation (5%) and for initial work (5%) component.

The watershed committee can receive funds directly or through the village panchayat to a separate account opened exclusively for this purpose. The transfer of funds from DRDA / ZP to the works committee are carried out on the approval of Project Implementation Committee.

PROGRAMME IMPLEMENTATION:

Project implementation Agencies are responsible for preparation of plans, submitting them for the approval of DRDA, monthly monitoring and reporting besides reviewing the work under progress. They are also responsible for constitution of the watershed associations and committee, training the team of committee member, secretary and volunteers and for organization of user groups and self-help groups. The evaluation of concurrent and post-facto nature are conducted by independent institutions appointed by the State Government or the District Advisory Committee.

Conclusion:

Irrigation is deemed necessary for the maximum production of most farm crops, especially in the arid and semi arid regions. Even in the areas of high rainfall,
irrigation of second and third crop or for multiple cropping when rainfall fails. According to the I.C.A.R., the production of irrigated crops is on an average 50 to 100 per cent higher than that of the unirrigated crops in the same locality. In India the growing population demands higher quantities of food grains for its consumption, but in the absence of which imports ranging from 150 to 200 Crores of rupees per annum have to be made. To cut short imports, self sufficiency in food grains is very necessary. This can be achieved, besides putting various inputs in the fields, through increasing irrigation facilities. In fact, among the measures that may be adopted for increasing area under cultivation and the yield of crops, the first place must be given to the works for the supply and conversation of water.

Irrigation in India has been practiced from ancient times and irrigation tanks and wells are a familiar feature of the Indian land scope to supplement and conserve the rainfall. Provision of water for the cultivation had figured prominently among the duties enjoined on the rulers of the land, who undertook the construction of irrigation works as benevolent works and many of the munificence of kings and philanthropists.

An intensive programme known as Integrated Dry Land Agricultural Development, was launched in 1970-71, initially in pilot projects (in Hyderabad, Rajkot, Hissar, Indore, Sholapur, Bellary, Jodhpur, Tirunelvelly and Jhansi). Later on it was introduced in 15 more pilot projects during 1971-74 in Anantapur, Palamau, Kutch, Mohindergarh, Jammu, Rowa, Akola, Hebbel, Bijapur, Udaipur, Bhilwara, Salem, Ghazipur, Agra and Bhubaneshwar. During 1977-78, 24 pilot schemes were in progress. Each project covered an additional area of 800 hectares. The programmes include cultivation of drought resistant, short duration and high yielding
varieties of crops with package of practices, land development including land shaping and land leveling, construction of well, bunds and bundies and distribution of improved farm machinery, seeds, fertilizers and pesticides.

Traditionally, India depended on agriculture and the Indian farmers themselves maintained the watersheds, ponds, tanks and irrigation system for centuries. As noted by Jalswal and Purandare (1995), the farmers and villagers themselves undertook activities such as desiltation of water channels and ponds, protection of vegetative and soil conservation activities collectively under the guidance of village councils. Increase in population pressure and erosion of socio-religious-political institutions degraded the land, water and vegetation.

The need for public effort in watershed development was recognized in India soon after independence. Watershed approach was put to practice for the first time in the country in 1949 by the Damodar Valley Corporation. Major multipurpose irrigation projects launched in India aimed at improvement of mega watersheds. The importance of micro watershed development was recognized and practiced in the country since 1973 due to the recommendations of the Task Force on Integrated Development or Drought Prone Areas. From 1979-80, watershed development was transferred to the State Governments as per the recommendations of the National Development Council.