

REPORT  
ON  
MINOR IRRIGATION WORKS  
IN  
BIHAR STATE



सत्यमेव जयते

MITTEE ON PLAN PROJECTS  
IRRIGATION TEAM  
NEW DELHI

*June, 1965*

## LETTER OF TRANSMITTAL

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Committee on Plan Projects.

Camp: Care Hotel Wyndham,  
42 West 58th Street,  
NEW YORK-19.

*Dated the 27th November, 1965*

My dear NANDA JI,

Studies of minor irrigation works in Bihar State taken up by the Irrigation Team have since been completed and a report thereabout is sent herewith for your perusal.

The bulk of minor irrigation works in the State are constructed under the Bihar Private Irrigation Works Act, 1922 on the basis of 50 per cent subsidy and 50 per cent loan. After completion, maintenance and operation of such schemes becomes the responsibility of the beneficiaries—presently through Panchayats. Usually Panchayats are unable to maintain the works satisfactorily. Utilisation remains poor in spite of the fact that there is no irrigation charge.

Recovery of loan is not yet effected in most of the cases. Arrears towards the end of 1963-64 stood at a figure of about Rs. 1.28 crores. Policy with regard to financing, maintenance, operation and irrigation assessment of such works in the State needs to be reviewed as suggested in the report.

There are two other Codes, namely, Bengal Irrigation Act of 1876 and Bihar Public Irrigation and Drainage Works Act of 1947, which govern minor irrigation works also. It will be advantageous if a unified Act is framed for the purpose.

There are about 1000 State tubewells in the State. Their performance, particularly that of North Bihar zones, is very poor. Financially the State is incurring an average loss of about Rs. 6000 per tubewell per year. For every acre irrigated the State loses over Rs. 80 in North Bihar and Rs. 25 in South Bihar. This financial position can improve if scientifically planned irrigated agriculture is practised on State tubewells, where ready-at-hand supplies are available all the year round.

A number of other recommendations have been made in the Report. Their implementation could help in optimising production from irrigated agriculture in Bihar. These could also help in planning and prospecting future programmes of irrigation expansion.

I take this opportunity to express our thanks to the State Government and their officers for the cooperation extended to us in conducting the studies.

With best regards.

Yours sincerely,  
M. THIRUMALA RAO

Shri Gulzarilal Nanda,  
Minister of Home Affairs,  
NEW DELHI.

## P R E F A C E

Irrigation Team, Committee on Plan Projects, Planning Commission took up the study of minor irrigation works in the State of Bihar in accordance with the Terms of Reference communicated *vide* Committee on Plan Projects memorandum No. COPP/(4)/17/58, dated 4th August, 1958 (Appendix I). The team comprised:

Shri M. Thirumala Rao, M.P.—Leader.

Shri Baleshwar Nath, Chief Engineer—Member.

Dr. Arjan Singh, Retd. Director of Agriculture, Punjab—Member.

Shri Mahavir Prasad, Irrigation Adviser, Ministry of Food and Agriculture—Member (*Ex officio*).

2. Preliminary discussions were held at Patna on August 26, 1964 (Proceedings given in Appendix II), and field studies were initiated thereafter,

3. The Team in their subsequent visits during 1964 and 1965 looked into planning, operational, organisational, maintenance as also financial and agricultural aspects of the various types of minor irrigation works, essential details of which have been discussed in the report.

4. Discussions were held concurrently with the State authorities at appropriate levels during the field studies as also subsequently. The recommendations as emerged out of the study have been summarised at the end of the report under a separate chapter, which bring to light policy matters needing special attention, apart from the details pertaining to individual works given in the report.

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## CHAPTER I

### GENERAL

**1.1.** Bihar has an area of 67,196 square miles, traversed by the Ganga from West to East. It is bound on the north by Nepal, on north-east and east by West Bengal, on the west by Uttar Pradesh and Madhya Pradesh and on the south by Orissa.

**1.2. Natural Divisions.**—Bihar can be classified into three natural regions, namely the plains of North Bihar, area south of Ganga river and the plateau of Chotanagpur. Amongst them the seventeen districts of the State have been grouped as below:—

North Bihar: Champaran, Saran, Muzaffarpur, Darbhanga, Saharsa, Purnea, North Monghyr and North Bhagalpur.

South Bihar: Shahabad, Patna, Gaya, South Monghyr, South Bhagalpur.

Chotanagpur: Palamau, Hazaribagh, Santhal Parganas, Ranchi, Dhanbad and Singhbhum.

A map of the State showing the district boundaries and the three regions is at Figure 1.1.

**1.3.** These three regions form distinct natural physical units; while the plains have poor slopes, hills, mountains and forests abound the plateau region, with altitudes ranging from 1,000 to 4,000 feet. Map at Figure 1.2 shows the physiography of the State.

**1.4. Geological features.**—The plateau portion of Bihar is formed by a great complex of ancient gneisses and granites belonging to the well known groups of lower Gondwana, the Vindhyan and Dharwar, and the Aravalli. The Chotanagpur plateau on the north and south is flanked by Aravalli formations which are also found in patches westwards. The formations contain iron ores which have great economic value. The most striking feature formed by the Vindhyan rocks is the scarp, which marks the northern flank of the Sone Valley.

**1.5.** The Bihar plains form part of the middle and the lower Gangetic plains. With very minor exceptions, they lie below 500 feet falling to less than 100 feet in the east. Physiographically these plains are much the same as the Upper Gangetic plain.

**1.6. Climate.**—The annual mean temperature varies from 24.0°C to 27.0°C. The maximum temperature varies between 40°C and 46°C, and the minimum between 4°C and 9°C. May is the hottest month of the year, with the mean temperature shooting above 32°C, and Gaya in South Bihar is the hottest place with the temperature rising up to 46°C.

**1.7.** The main seasons are: (i) the hot weather season from March to mid-June; (ii) the rainy season from mid-June to mid-October; and (iii) the winter season from mid-October to February.

**1.8. Rainfall.**—Normal average rainfall for the State is 1,280 millimetres (50.4 inches). Nearly 85 to 90 per cent of the precipitation is confined to the period between mid-June and mid-October. The late September-October

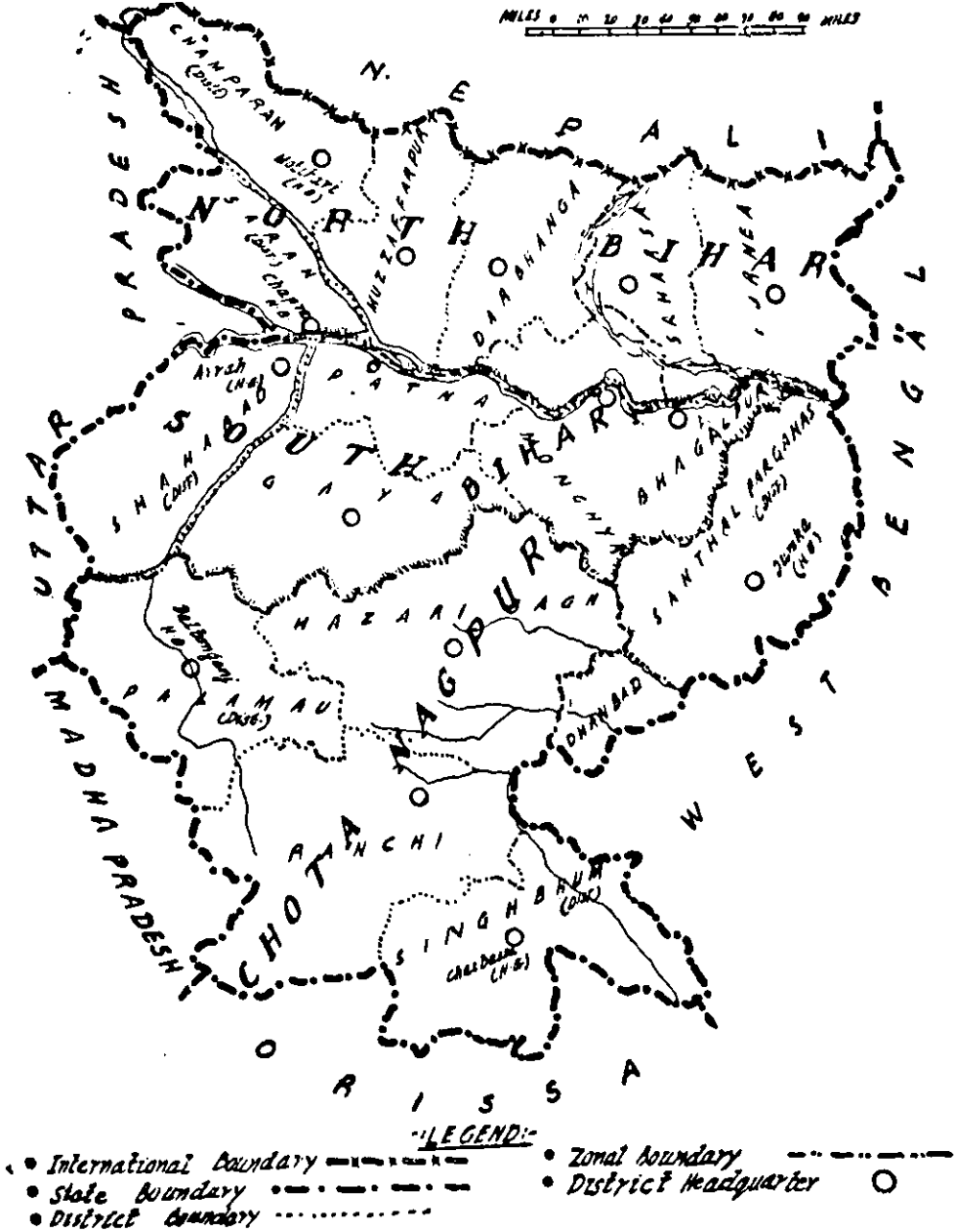


FIG. 1-1 Map of Bihar State showing district boundaries and three natural regions.

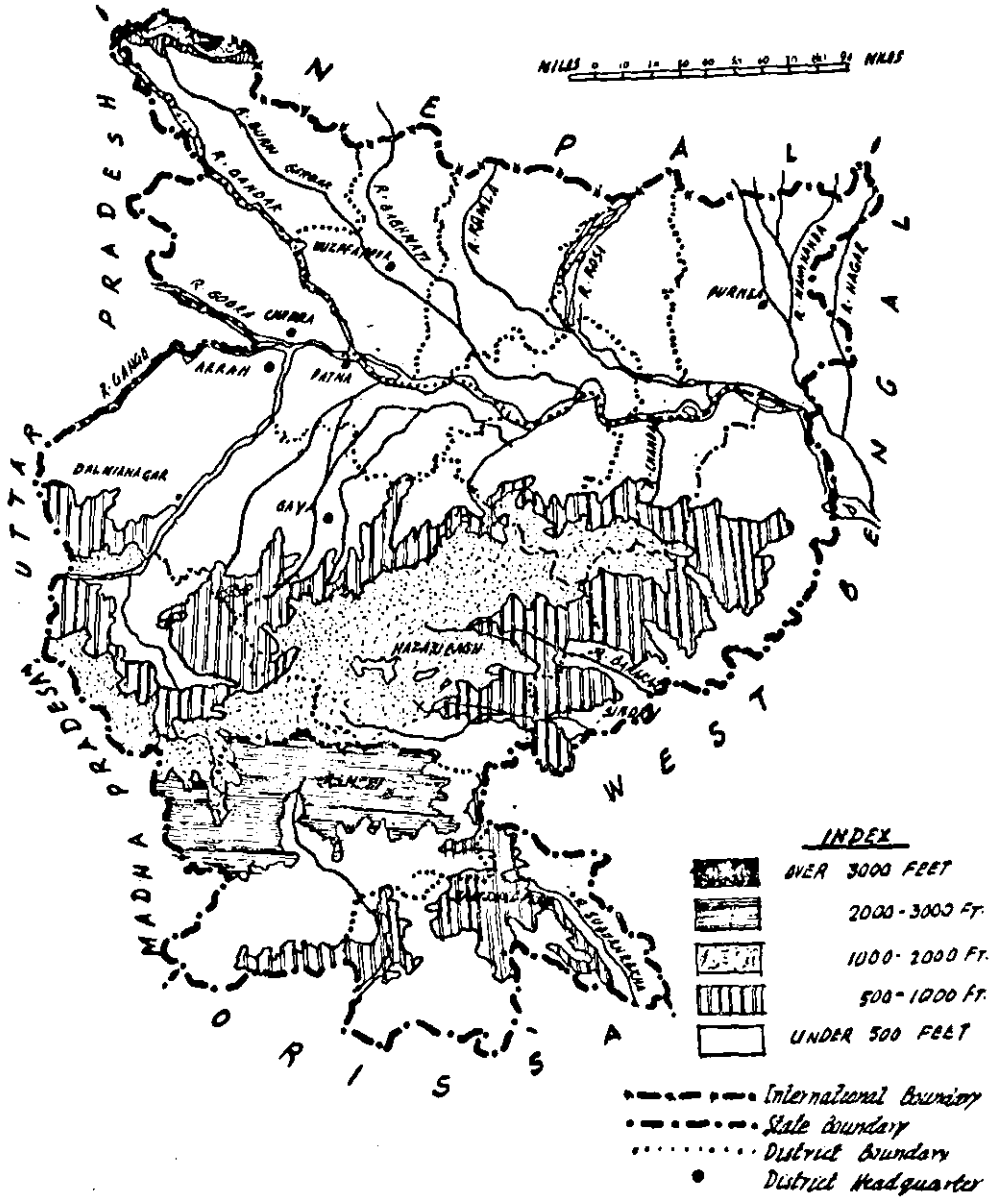


FIG. 1.2 Map Bihar State showing physiography of the State, and old canals and river systems.



rains, known as 'Hathia' hardly exceed 5 centimetres (2 inches) yet they are of such crucial importance for raising the seasonal crops that their success or failure makes all the difference between plenty and scarcity.

**1.9.** Rainfall is generally heavy in the Chotanagpur plateau but the area of heaviest rainfall is the districts of Champaran and Purnea in North Bihar. District-wise normal annual rainfall is given in Table 1.1.

TABLE 1.1

District	Normal Rainfall
1. Patna	1002 mm
2. Gaya	1147 „
3. Shahabad	1122 „
4. Saran	1140 „
5. Champaran	1425 „
6. Muzaffarpur	1188 „
7. Darbhanga	1249 „
8. Monghyr	1223 „
9. Bhagalpur	1157 „
10. Saharsa	1395 „
11. Purnea	1589 „
12. Santhal Parganas	1384 „
13. Hazaribagh	1259 „
14. Ranchi	1458 „
15. Palamau	1312 „
16. Dhanbad	1334 „
17. Singhbhum	1402 „

*Appendix III* shows monthwise distribution of the normal rainfall in each district. Figure 1.3 shows isohyetal contours of the rainfall in the State.

**1.10.** Population of the State as per census of 1961 is 4,64,55,610, whereas, in 1951 it was 3,87,83,778. It has thus recorded an increase of 19.78 per cent in a decade (1.98 per cent per annum) against the all India increase of 21.50 per cent. Bihar is now the second most populous State in India, the first being Uttar Pradesh (74 millions). The State occupies third place in per square mile density of population. It is 691 and that of West Bengal and Kerala is 1,032 and 1,127 respectively against an all India average of 373.

**1.11. Rivers.**—The Ganga flows west to east over a distance of about 350 miles in the State. Other important rivers of the State are the Saryu, the Gandak, the Burhi Gandak, the Kamala, and the Kosi in North-Bihar, the Sone, the Punpun and the Phalgu of the South Bihar, and the Damodar, the Subarnarekha and the Koel of Chotanagpur area. They are marked on the map at Figure 1.2.

**1.12. Forests.**—Area under forests in Bihar State is approximately twelve thousand five hundred square miles. Out of it about eleven thousand square miles constituted the erstwhile private forests, which came under the State Government management in about 1950. Area statistics of the State are given in Table 1.2.

TABLE 1.2

*Total area and classification of area (Bihar State) 1961-62 ('000 Acres)*

	Total Geographical area	Forests	Non-Agri., Barren & unculturable lands	Uncultivated pastures trees Grove & waste land	Fallows current as well as other than current	Net area sown	Total cropped area
Bihar	42823	9165	5574	2410	5041	20633	27511
All-India	738378	137737	120826	93171	52578	334066	384611

*Source.*—Directorate of Economics and Statistics, Area Classification 1961-62 (Provisional)

**1.13. Soils.**—The Bihar plains are among the most fertile agricultural tracts in India. The soil composition favours the cultivation of almost every crop that can be produced in semi-tropical low land. The map at Figure 1.3 shows the broad classification of soils in Bihar. Soils north of the Ganges vary from clay loam to sand loam and are natural to somewhat alkaline in reactions. Those south of the Ganga are somewhat heavier and finer in texture. The PH values are almost neutral and in fact, become acidic towards the southern parts of the area. Soils of the Chotanagpur plateau formed on rocks are markedly acidic in reaction. They are subdivided into red and black (black cotton soils), and red soils. Both in the Gangetic plains and in the plateau the soil is significantly deficient in organic matter and nitrogen. This can be corrected with larger application of farm yard manure and other nitrogenous fertilisers.

**1.14. Agriculture.**—The nature of agricultural production is largely determined by the character and distribution of rains during the principal agricultural seasons. For its overall agricultural production the State is, to a large extent, dependent on rainfall.

**1.15.** Even where irrigation facilities exist, they are mostly limited to one crop of paddy which accounts for nearly 63 per cent. of the total area under cereals. However, with the development of irrigation on new projects *e.g.*, Kosi Sone extension and Gandak as well as irrigation, tubewells, a second crop in *rabi* is envisaged. Table 1.3 gives area, production and yield of various crops in the State for the year 1962-63.\*

TABLE 1.3

*(Area in Acres/production/000 tons Yield in lbs.)*

Crop	Area	Production	Average yield per acre	
			Bihar	All India
1	2	3	4	5
Rice	12843	4213	735	821
Jowar	20	6	672	469

*Source.*—\*Directorate of Economics and Statistics Min. of Food and Agriculture.

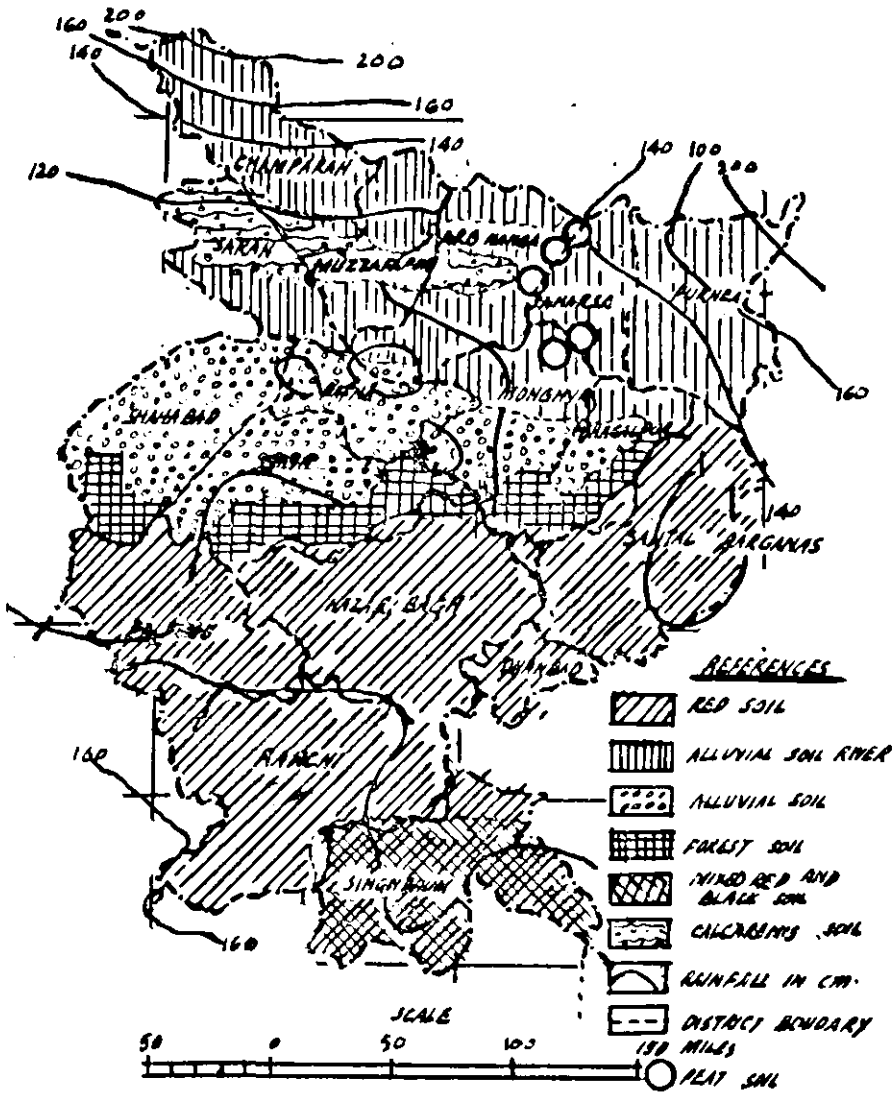


FIG. 1.3—Map of Bihar State showing broad classification of soils and isohyetal contours.

1	2	3	4	5
<i>Bajra</i>	46	7	341	322
Maize	2045	859	941	881
<i>Ragi</i>	463	100	484	733
Small millets	566	93	368	351
Wheat	1768	519	658	738
Barley	1005	237	528	727
Total cereals	18756	6034	721	655
Gram	1266	281	497	556
<i>Tur</i>	397	105	592	581
Other Pulses	3769	813	483	335
Total Pulses	5432	1199	494	447
Total food-grains	24188	7233	670	613
Castor Seed	17	5	659	206
Sesamum	70	8	256	167
Rapeseed & Mustard	263	52	443	371
Linseed	265	31	262	202
Total oil seeds	615	96	350	422
Sugarcane	400	4800	26,880	3,5636
Chillies	80	19	532	557
Cotton	5	1	78 (bales)	106 (bales)
Jute	490	1024	836 (bales)	1025 (bales)
Mesta	129	196	608	705
Sannhemp	27	5	415	358

1.16. It will be seen that next to paddy which is 63.09 per cent of the total cereals grown in the State, maize, occupies second place. Average yield of almost all the crops in the State are lower than the all India averages, except in the case of maize which is 981 lbs. per acre against 881 lbs. all India average. Similarly, yields of oil seed crops of the State are also higher.

1.17. **Size of Holdings.**—One of the important reasons for low productivity in the agriculture sector of the State is the uneconomic nature of average holdings. This aspect was analysed by the Agricultural Labour Enquiry Committee, Bihar, 1951. The result for the year 1954-55 are given in the Table 1.4.\*

TABLE 1.4

Grade of holding	Percentage of holding	Percentage of total areas
Below 1 acre . . . . .	34.2	4.2
1.0 to 2.5 acres . . . . .	22.8	10.6
2.5 to 5 acres . . . . .	21.2	19.8
5 to 10 acres . . . . .	14.1	27.4
10 to 50 acres . . . . .	7.5	33.1
50 to 100 acres . . . . .	0.2	4.9
TOTAL . . . . .	100.0	100.0

Source.—\* Bihar Statistical Hand Book 1960, page 42

**1.18. Irrigation.**—Provision of assured irrigation facilities is one of the major determining factors of yield capacity in agricultural land, along with application of manures and fertilizers and improved seeds, techniques and implements. Irrigation statistics of Bihar (from various sources) for the year 1961-62 compared to All India figures are given in the Table 1.5.\*

TABLE 1.5  
*Sourcewise area irrigated 1961—62*

Source of Irrigation	Bihar		All India	
	Area (acres)	Percentage to total area irrigated	Area (acres)	Percentage to total area irrigated
(1)	(2)	(3)	(4)	(5)
<i>Canals:</i>				
1. (i) Govt. Canals . . . . .	13,07,000	27.23	2,30,77,000	39.34
(ii) Private canals . . . . .	80,000	1.67	28, 27, 000	2.92
TOTAL . . . . .	13,87,000	28.90	2,59,04,000	42.26
2. Tanks . . . . .	5,53,000	11.52	1,12,18,000	18.35
3. Wells . . . . .	8,07,000	16.81	1,80,37,000	29.50
4. Other sources . . . . .	20,53,000	42.77	59,89,000	9.89
TOTAL . . . . .	48,00,000	100.00	6,11,98,000	100.00
1. Percentage of area irrigated to net area sown		23.2		18.2

**1.19.** It will be seen from the above Table that in Bihar 23.2 per cent of the net area sown received irrigation in 1961-62 against an all India percentage of 18.2. The importance of the service rendered by Minor Irrigation Works to the irrigated agriculture of the State is evident from their contribution of 71.10 per cent (total of items 2, 3 and 4 of Table 1.5) compared to 57.74 All India percentage. A map showing the rivers and the old canals in operation in the State is given in Figure 1.2.

**1.20.** With the rapid growth of population in the State it is imperative to explore possibilities of extension of irrigation facilities and other measures conducive to achieve higher yields.

**1.21.** Development of irrigated agriculture in the State is, by and large, poor. The whole agriculture seems to be based on one crop rain fed agriculture. Even where irrigation facilities exist, their use is mostly made for supplemental purposes. A year round agricultural operation programme of irrigated agriculture needs to be developed with a view to maximise agricultural production.

**1.22. Minor Irrigation.**—Expenditure incurred on Minor Irrigation Schemes in the State Plans and the area commanded by them is indicated in the following page.

\*Source.—Directorate of Economics and Statistics, Ministry of Food & Agriculture

Plans	(Rs. in lakhs)		(Area in lakh acres)			
	Allocation	Expenditure	Area proposed to be benefited			
			Works under Agri. & Rev. Dept.	Works under C. D. Dept.	Works under Irrigation Dept.	Total
1st Plan	1,126.63	1,347.11	16.44	..	0.51	16.95
2nd Plan	1,044.14	1,289.91	11.63	13.11	1.53	26.27
3rd Plan	1,709.83	1,233.08	3.39	6.30	10.94	10.63
		(till 1963—64)	(By M. I. Dept.)			

These figures show that during plan period an expenditure of Rs. 38.70 crores has been incurred on Minor Irrigation Schemes in the State. More is proposed to be spent in coming years. This study is aimed at an appraisal of techno-economic aspects of Minor Irrigation Works in the State.

## CHAPTER II

### TANKS AND CANALS

2.1. Out of 27.5 million acres of annual cropped area in Bihar, 4.8 million acres (*viz.*, 17.45 per cent) receives some sort of irrigation from one source or the other. Most of the irrigation provided is of a protective nature for paddy against any drought or long break during monsoon months.

2.2. Of these 4.8 million acres irrigated area, 1.39 million acres is irrigated by canals (both large and small), 0.55 million acres by tanks, 2.05 million acres from other sources *e.g.*, pynes, ahars and lifts etc., and the remaining 0.81 million acres depend on wells. Thus the most important sources of minor irrigation in the State are the tanks and small diversion canals; there being no big reservoir in the State and their being only a few large canal systems *e.g.*, Triveni Canal and Sone Canal systems.

2.3. Local rain is the only source of water for the small tanks and diversion canals. It is stored in small tanks or where feasible it is diverted by diversion weirs across small local streams into minor canals for irrigating paddy and other *khari* crops.

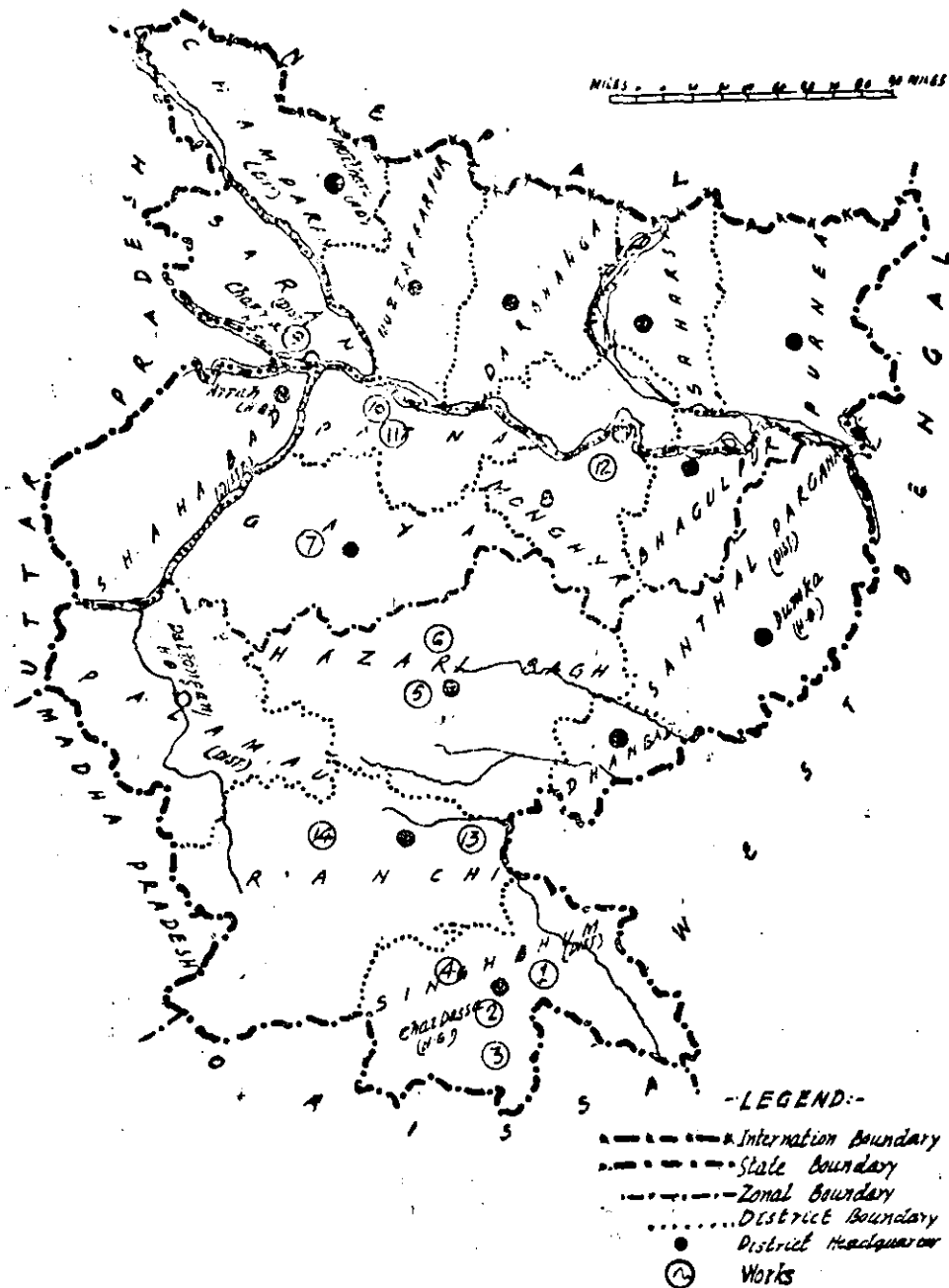
2.4. Such small tanks and diversion canals have been in use in Bihar since olden times. These small irrigation works used to be maintained by the zamindars, labour being supplied by the beneficiaries. But with abolition of *zamindari* system, these works ceased to receive due attention. Number of such tanks is large, hundreds of them are stated to be in a state of disrepair. Some are being repaired and remodelled wherever feasible. Alongside new ones are being constructed under Plan schemes.

2.5. During field visits the Team had occasion to visit some of these tanks and diversion canals. Their locations are marked in the map at Fig. 2.1. Observations of the team are contained in the following paragraphs.

2.6. **Tudi Diversion Weir and Canal.**—This is a new minor irrigation scheme of the Third Five Year Plan. It lies in Fotka Block, district Singhbhum. The scheme estimated originally to cost Rs. 73,000 for providing irrigation to 293 acres has been recast. Its revised estimate amounts to Rs. 1,81,000 and the revised area likely to be benefited is 569 acres. The revised cost per acre works out to Rs. 318.

2.7. The Tudi Stream at the site of the weir is reported to have a catchment of about 4 sq. miles. The normal discharge in the stream during the month of September is only about 10 cusecs which dwindles down to about 2 cusecs by the end of October.

2.8. The scheme includes construction of 115 ft. long weir and a 9,200 ft. long canal from its left flank. A 5,300 ft. long branch channel takes off from the canal. The weir crest is 2.5 ft. above the head regulator sill. The canal has a bed width of 3 ft. and a full supply depth of 3 ft. at its head. Its longitudinal slope is 1 in 2,500. The canal is designed to carry a discharge of 14 cusecs although it is envisaged to run ordinarily with only 7 cusecs to meet project requirements.



Ref. No.	Name of the Work	District	Ref. No.	Name of the Work	District
1.	Tudi Diversion Weir	Singbhum	10.	Bedauli Diversion Weir	Patna
2.	Lorgara —do—	—do.—	11.	Dekuli Diversion Weir	—do.—
3.	Company Bandh	—do.—	12.	Karma Diversion Weir	Monghyr
4.	Kaida Diversion Weir	—do.—	13.	Barwa Dag Diversion Weir	Ranchi
5.	Chharwa Dam	Hazari Bagh	14.	Bucha-opa Reservoir Scheme	Ranchi.
6.	Lotia Diversion Weir	—do.—			
7.	Jamuna Diversion weir	Gaya			
8.	Aghara Storage Tank	Monghyr			
9.	Ram Bandh Weir	Saran			

FIG. 2. 1.—Map of Bihar showing Division Weirs and Canal and Tanks visited by the Team.



**2.9.** At the time of Team's visit the weir was under construction. The authorities have informed that the masonry weir and headworks have since been completed. The canal, its head regulator and the branch channel were completed. But the outlets for the system had not yet been planned. They proposed to fix the outlets more or less arbitrarily after the completion of the construction. This is likely to affect adversely the development of irrigation on the scheme. It is desirable that outlets are planned carefully considering the contours of the commanded area.

**2.10.** The Team was informed that after the completion of the scheme, the project along with its operation and maintenance will be handed over to the concerned Panchayat and half of the cost of the scheme will be recovered from the beneficiaries in easy instalments spread over a number of years. It appears doubtful if Panchayats can operate and maintain such works satisfactorily.

**2.11.** No watercourses are planned for proper utilisation of water. It would seem necessary that watercourses are properly aligned and constructed in the command of individual outlets. They should ordinarily be constructed by the beneficiaries concerned failing which action could be taken by the Government on the cost recovery basis. The State authorities have informed that necessary technical guidance and help is now being given for the lay-out and construction of water courses. The recently enacted Village Channel Act empowers the State Government to construct the watercourses and realise the cost thereof from the beneficiaries in case they fail to execute the construction thereof.

**2.12. Lorgara Diversion weir and Canals.**—The Scheme is situated in Jaganathpur Block, P. S. Rajnagar, district Singhbhum. The stream at the weir site has a catchment of 4.75 sq. miles. The sill of the under sluice is at R. L. 176.50 that of the head regulator at 178.50 and the crest level of the weir is at 181.00. The left and right bank canals are 86 and 63 chains in length respectively, with 3 ft. bed width 2 ft. full supply depth and a longitudinal slope of 1 in 2,500 each designed to carry 10 cusecs discharge.

**2.13.** The scheme is proposed to benefit an area of 664 acres. As per original estimate, the scheme was to cost Rs. 69,400. The estimate has since been revised for Rs. 1,59,400. The incidence of cost per acre has thus risen from Rs. 105 to Rs. 240.

**2.14.** At the time of Team's visit the under sluice, weir and the head regulators were completed but the work on the canals was held up due to delay in acquisition of land. To avoid unnecessary locking up of the capital, the work on the entire scheme should have been started simultaneously after acquiring the land required for the canals. Early steps to expedite the finalisation of the land acquisition proceedings may be taken if not yet finalised.

**2.15.** Outlet commands, their sizes and the field channel alignments should also be decided in time so that development of irrigation is not held up for these after the construction of the project is completed.

**2.16. Kaida Diversion Weir** visited by the Team is situated in village Kaida, district Singhbhum. The stream on which the project is located has a catchment of 6.16 sq. miles above the weir.

**2.17.** It is understood that originally feasibility of a storage project was examined for a 60 ft. high dam. But before execution, the scheme was reinvestigated and a diversion weir was eventually considered economical. As such Kaida diversion weir came up in the year 1947 at a cost of Rs. 24,000 to provide irrigation to 1,000 acres, incidence of cost per acre coming to Rs. 24 only.

**2.18.** The scheme has been provided with a pervious waste weir consisting of boulder-crates laid in iron wire mesh. The weir thus has come to be called 'Tarangar boulder weir'. The canal takes off on the left flank of the weir. The head regulator is fitted with sluice gate. There was only about 3 cusecs discharge in the stream towards the end of October, 1964.

**2.19.** The scheme was reported to be doing satisfactory irrigation. It is being maintained and operated departmentally. The performance figures and operation cost statistics have not been supplied by the authorities concerned. It was found that a regulation beldar is kept all the year round for the canal. It is felt that in such cases employment of a seasonal beldar from May to October should be ample, there being no water in the stream from November onward.

**2.20. Company Bandh Diversion Project.**—In village Jaganathpur of P. S. Noamundi, district Singhbhum, the Team visited company Bandh Diversion. Weir constructed by the Unified Minor Irrigation Division, Chaibassa. Estimated cost of the scheme is Rs. 16,190 and the area benefited is stated to be 823 acres. Incidence of cost per acre comes to just Rs. 20.

**2.21.** The stream on which the diversion weir is built has a catchment of 1.75 sq. miles. Total length of the weir between the two abutments is 100 ft. The crest of the weir is over 11.5 ft. above the lowest bed level of the stream at the weir site. The length of the earthen embankment is 1,200 ft.

**2.22.** Only one canal takes off on the right bank. Its length is 5,200 ft. and the branch canal taking off from it has a length of 2,300 ft. The crest of the canal head regulator is 2.5 ft. below the weir crest. Full supply depth of both the main and branch canals is 2 ft. and their bedwidths 3 ft. Their longitudinal slopes are 1 in 2,500 and capacities 14 cusecs each.

**2.23.** The beneficiaries appeared quite enthusiastic and are also stated to have constructed some of the main watercourses. In *Kharif* 1964, the scheme is stated to have provided irrigation in the entire ayacut of 823 acres. However, it could not be verified as there is no recording of irrigation.

**2.24.** The project is stated to have been handed over to Panchayat for operation and maintenance. So far no maintenance has been done. The Block headquarters are within a mile from the site of the project. The B.D.O. also met the Team at site. He could not furnish any information regarding increase in yield with the introduction of irrigation by this project. General appearance of the crops both in the irrigated and unirrigated fields appeared equally good. Crop cutting experiments both in the irrigated and the adjoining unirrigated areas could help in ascertaining the increase in yield.

**2.25. Chharwa Dam** is situated at about four miles west of Hazaribagh town. This is an irrigation-cum-water-supply project. It provides irrigation to an area of 1,721 acres besides supplying water for domestic use to Hazaribagh Town. The dam was constructed by the Damodar Valley Corporation in the year 1954 at a cost of Rs. 2,23,364. It was later on handed over to the Irrigation Department.

2.26. The catchment above the dam is 6.73 sq. miles. Its length is 2,633 ft. and its storage capacity is 4,765 acres ft. Annual irrigation for the years 1961-62 to 1963-64 from the dam is reported to be as under:—

Year	Irrigation in acres		
	Kharif (mostly paddy)	Rabi	Total
1961—62	1,316	—	1,316
1962—63	1,125	110	1,235
1963—64	1,025	130	1,155

2.27. The authorities in charge could not explain the reasons for the decline in the performance of the project, whether it was due to shortage of water or lack of demand.

2.28. The Municipality is responsible for the town water supply while the project is in the overall control of the State Irrigation Department. No account of the quantities of water supplied for either purpose is being maintained. The Team suggests keeping of proper water account so that it may be possible to judge as to what extent the dual objective of the project is being achieved. Proper assessment of supplies available in the reservoir for rabi irrigation could also then be made and a comprehensive and sustained programme to grow *rabi* crops of which there are good prospects could be launched.

2.29. No water rate is being charged for the irrigation. The project is under Bihar Public Irrigation and Drainage Works Act. The recovery of the 50% cost of the project, which according to the Act is recoverable from the beneficiaries, has not yet been started. No water courses exist and the irrigation mostly takes place on field to field basis.

2.30. **Lotia Diversion Weir.**—About 12 miles north from Hazaribagh *en route* to Gaya lies the Lotia diversion weir and canal project completed in 1958-59 at a cost of Rs. 2,44,675. The catchment above the weir is 15 sq. miles. The weir is 88 ft. long and the weir crest is 6 ft. above the under-sluice sill. A canal 8 ft. wide and 2.25 ft. deep with a capacity of 30 cusecs takes off from above the weir. Its C.C.A. is 1,600 acres. Total length of the canal is 6.25 miles.

2.31. The project constructed under the Bengal Irrigation Act, 1876 is in the charge of the Irrigation and Waterways Department. Its operational and financial performance is given in Table 2.1.

TABLE 2. 1

Year	Irrigation			Amount assessed	M & R Expenditure
	H. W.	Kharif	Rabi		
1	2	3	4	5	6
1960—61	..	5	..	50	N. A.
1961—62	..	4	..	40	N. A.
1962—63	..	17	..	170	12,548
1963—64	..	400	..	4,000	2,995
1964—65	..	330	..	3,300	6,000 (estimated)
Total for 1963—64 1964—65	..	730	..	7,300	8,995
Average	..	365	..	3,650	4,498

(Area in acres)  
(Amount in Rs.)

The project costing Rs. 2.5 lakhs even five years after completion could only yield 400 acres irrigation in *kharif* 1963-64 which came down to 330 acres in the subsequent year against the annual targeted irrigation of 1,600 acres. Thus the percentage of utilisation in 1963-64 and 1964-65 works out to 23 and the average M & R expenditure alone exceeds the amount of water rates realised by about Rs. 850 annually. There was about 10 cusecs discharge in the stream at the weir site in end of October, 1964 when the Team visited the scheme, which is, stated to come down to about three cusecs towards the end of February. Possibilities of having some *rabi* irrigation need to be looked into. The project has so far done irrigation only in *kharif*.

**2.32.** No watercourses are planned for the area commanded by the canal. The outlets also do not appear to have been fixed on any rational basis. For quick development of irrigation and optimum utilisation of water it is necessary that the outlets are located and their sizes fixed scientifically; ensuring also that irrigation takes place through properly aligned watercourses and field channels and not on field to field basis.

**2.33. Jamuna Diversion Weir and Canal.**—About 8 miles from Gaya the Team saw Jamuna Diversion Weir in village Chirki, P.S. Sherghati. The project is stated to have been constructed by the Agriculture Department in the year 1958 at a cost of Rs. 75,200 to serve an ayacut of 2,500 acres. Incidence of cost per acre is only about Rs. 30. Previously at this site an inundation canal took off directly from the river Jamuna. The masonry diversion weir was planned and constructed to provide more assured irrigation.

**2.34.** The project is stated to be irrigating about 1,500 acres of paddy in *Kharif* and about 400 to 500 acres area in *rabi*. Further about 500 acres area of the command is likely to be reclaimed. The ayacut is served by 1.5 mile long left bank canal and 2.5 miles of branch canals. Authorised discharge of the canal at head is stated to be 59 cusecs. Full particulars of the scheme and its functioning could not be obtained from the authorities concerned.

**2.35.** The area on the right side of river Jamuna is in the command of Lilajan Irrigation Project, which is in the charge of Irrigation and Waterways Department. This project provides irrigation to some area on the left side of the river also, through a crossing on the river across the command of the Jamuna diversion canal.

**2.36.** Lilajan project is operated under Bengal Irrigation Act III of 1876. Water rates are levied on the irrigation therefrom. The Jamuna diversion canal is governed by the provisions of the Bihar Private Irrigation Works Act of 1922. Works of the category constructed under the Bihar Irrigation Act are subsidised by the State Government to the extent of 50 per cent and the remaining 50 per cent cost is required to be recovered from the beneficiaries under Section 35A of the Bihar Private Irrigation Works Act. No recovery from the beneficiaries is stated to have been effected so far on the Jamuna diversion weir though it was completed more than six years ago. This differential treatment given to the cultivators of commands so interlinked as those of Lilajan and Jamuna Irrigation Projects, is likely to create dissatisfaction in the minds of those who pay water rates. Action to remove such anomalies seems called for.

**2.37. Aghara Storage Tank.**—Aghara Tank is an old tank in village Aghara, P. S. Jamui, district Monghyr. It was repaired and improved in 1963 at the request of the beneficiaries at a cost of Rs. 18,623. It is meant

to benefit 379 acres. 1/5 sq. mile is the catchment area of the tank. The catchment lies in the 40 inches annual rainfall zone. Length at top of the dam is 63 chains and height 7 ft. Area of submergence is stated to be about 80 acres. Gross storage capacity of the reservoir is 2,78,784 c.ft. with no dead storage. The tank is provided with an 18 ft. long clear over-fall type waste weir.

2.38. Irrigation is done through direct outlets from the tank. Taken up under the Bihar Private Irrigation Works Act, 1922, the scheme on completion is to be transferred to the *Gram Panchayat* concerned for maintenance and functioning and 50% of the cost is to be recovered from the beneficiaries.

No record is available of the performance of the tank for years prior to its special repairs in 1963. Performance for 1963-64 as intimated by the authorities in charge is:—

Name of the Crop	Irrigation (in acres)
Kharif 1963 . . . . .	360
Rabi 1963—64 . . . . .	80
	TOTAL 440

2.39. **Ram Bandh Diversion Canal and Weir.**—This is an old channel situated in village Bangra, Manjhi P.S., district Chapra. It used to be run by putting temporary earthen bund in the nadi. In order to have an assured supply, on the request of the beneficiaries, a sluice regulator of two spans with earthen flanks has been put across the stream. The project for improvement of the old bund and provision of the sluice regulator is estimated to cost Rs. 36,220.

2.40. The work on the scheme was taken up sometime in 1963-64 and an expenditure of Rs. 19,810 incurred up to June, 1964. The work of the regulator was left incomplete and the floods of 1964 passed over it. The sluice gates were not properly fixed, the friction blocks were not set and were consequently displaced. Even the back earth filling was left incomplete and the flank embankments weak. It is lucky that during the floods no serious damage occurred to the work. The work was at a stage when it should not have been left incomplete. It is hoped that the work would have been completed satisfactorily now.

2.41. The old canal taking off on the left above the regulator is about 3/4 mile in length. This existing canal will continue to be used. It is a *zig-zag* channel having no proper alignment and side slopes. It will carry about 10 cusecs discharge. Nothing is proposed to be done to stream-line this channel which requires reshaping, desilting, provision of head regulator and realignment at places for efficient working.

2.42. The channel commands 400 acres culturable area. The anticipated irrigation is 400 acres paddy in *kharif*. It is reported to have irrigated the 400 acres *kharif* and 50 acres *rabi* in 1964-65. Evidently the performance figures are not based on any actual recording. It will seem better if actual field-wise recording of irrigation is done.

2.43. The channel is not provided with any outlets either. The cultivators cut the banks as and where they like to irrigate their fields. Now that the diversion regulator is provided and supply is assured, it is desirable that the channel too is remodelled and provided with proper outlets and water courses. With the supplies available it should be possible to extend the command to other adjoining areas as well.

**2.44. Bedauli Diversion Weir.**—The weir is reported to have been constructed by the Agriculture Department in the year 1951-52 at a cost of Rs. 19,494. Incidence of cost per acre is stated to be Rs. 8. Command of the project thus comes to about 2,400 acres which appears rather exaggerated for a project of this size. There is no regular canal taking off above the weir. The water is directly diverted into paddy fields.

**2.45.** The weir is provided with 11 planks operated spans of 4 ft. each. Operation of the weir planks is with the beneficiaries who are also supposed to be responsible for its maintenance. The right and left flank embankments are in a state of disrepair which, for effective functioning of the scheme, need to be strengthened and brought to proper sections. There is no record or statistics to show the actual benefit being derived from the project.

**2.46. Dekuli Diversion Weir.**—Little down stream on the same Marsume Nadi on which Bedauli M.I. Project is located, the Agriculture Department also constructed Dekuli diversion weir in village Dekuli, P.S. Bihta, district Patna in the year 1963 at a cost of Rs. 23,985. Cost per acre is stated to be Rs. 14. The ayacut to be served thus work out to about 1,710 acres. The waters in the Marsume Nadi are also augmented by the spill water of the Patna Canal and flood waters of river Sone. No regular canal is there to use the diverted water. It flows through a pyne direct into paddy fields.

**2.47.** The weir is provided with 10 spans of 5 ft. each. Its operation and maintenance is with the beneficiaries. The fall board shutter provided for the pyne sluice and more than half of the railings of the weir were found missing. It shows the desirability of some sort of technical inspections at regular intervals of fixtures etc., on irrigation works handed over to the beneficiaries after execution.

**2.48. Kerma Diversion Irrigation Scheme.**—This an old "Fard-abpashi" irrigation scheme in village Kerma, Sub-Division Jamui, district Monghyr. At the request of its beneficiaries, the scheme has been renovated at an estimated cost of Rs. 49,587. The scheme as renovated consists of a 30 ft. long diversion weir fitted with an undersluice shutter and a quarter mile long canal of 6 ft. bed width and 2.5 ft. depth.

**2.49.** The scheme is expected to benefit 1,000 acres paddy area annually. In *kharif* 1964 about 200 acres paddy is reported to have been irrigated by the scheme.

**2.50.** The scheme has been executed by Agriculture Department. It is reported that there is practically no catchment above the diversion weir and the rainfall is below 30 inches on an average. If this information is correct the benefits from the scheme have evidently been overestimated due to insufficient technical investigation. Schemes of this magnitude need thorough survey and investigation by technical personnel before being executed. The scheme has not yet been transferred to beneficiaries.

**2.51. Barwadag Diversion Weir** is located on Barwadag stream in Angarha Taluka, district Ranchi. The Project was originally constructed by the Agriculture Department at a cost of Rs. 27,877. Renovation of the scheme was done by the Minor Irrigation Department in the year 1964 with an expenditure of Rs. 41,330. Total expenditure on it thus comes to Rs. 69,207. The scheme is designed to irrigate 193 acres area and incidence of cost per acre works out to Rs. 385. Catchment area of the stream at the weir site is 3 square miles lying in an annual rainfall zone of 40 to 50 inches. The weir is 89.5 ft. in length designed to pass 4.5 feet maximum flood depth.

Canal taking off from the left side of the weir is 2,500 feet long having 4 feet bed width, 2 feet F.S. depth, 1 : 1 side slope and 1 : 2,000 bed slope. Designed discharge of the canal is 6 cusecs.

**2.52.** Enthusiastic cultivators used to put earthen obstruction in the stream at the weir site to derive benefit of the diverted supplies. *Pucca* masonry weir was constructed under the Bihar Private Irrigation Works Act of 1922, which after completion had been handed over to the Panchayat for operation and maintenance. It is a non-Fard-Abpashi scheme and 50 per cent of the cost is recoverable from the beneficiaries.

**2.53.** At the time of the Team's visit water sprouts through the foundations of the weir were noticed at various places. They need immediate attention as otherwise the entire foundation may get undermined.

**2.54.** Head reach portion of the canal runs along the toe of a hillock. The only cross drainage syphon provided under the canal proved inadequate and a part of the canal got washed off last year. It has since been repaired and an R.C.C. pipeline laid in a length of about 100 feet. To avoid its getting choked with heavy debris fixation of a netting upstream of the mouth of the pipeline is suggested.

**2.55.** Since no scouring vents or holes have been provided in the body of the weir, bed of the stream above the weir has got silted up considerably. This may be looked into. Possibility of raising the weir further and extending the command could be investigated.

**2.56.** Suitable field channels may be aligned in the commanded area to replace the present field to field wasteful system of irrigation. This was explained to the village Sarpanch. He appreciated the suggestion and promised to get them constructed by the beneficiaries, if the technical staff gave them the necessary layout etc. He also promised to arrange for ordinary clearance and repairs of the channel in case the technical staff instructed them at site and supervised the work. This may be tried.

**2.57. Bucha-Opa Reservoir Scheme.**—27 miles west of Ranchi on Ranchi Lohardaga road the Irrigation and Waterways department has constructed Bucha-Opa Reservoir Project. Estimated cost of the project was Rs. 7,21,000. Construction of the scheme taken up under the Bengal Irrigation Act III of 1876 in 1955 was completed in the year 1957 at an actual cost of about Rs. 9.5 lakhs.

**2.58.** The scheme is located on Opa stream a tributary of the South Keol river, in Mandar Anchal-cum-Development Block, Ranchi district. Catchment area of the stream at the dam site is 3 square miles. The earthen dam is 3,500 feet in length having top width of 15 feet and maximum height above the bed 46 feet. The reservoir has a gross capacity of 2,300 acre feet at F.R.L., out of which storage is 2,000 acre feet. Area of submergence at F.R.L. is 200 acres.

**2.59.** The dam is provided with masonry spillway with crest level at R.L. 1,026.50 capable to pass a discharge of 340 cusecs. Lowest bed of the reservoir is at R.L. 994.00. There are two canals taking off from the reservoir one on either side of the spillway. The left and right vents of the head regulators are of 1'-6" and 1'-9" diameter respectively with crest levels at R.L. 1,012.50. Total length of the main and branch canals is seven miles and that of the distributaries is 1,300 feet. Each canal is designed to carry 20 cusecs.

2.60. The scheme originally envisaged to provide 1,200 acres irrigation in *kharif*, and 500 acres in *rabi* and hot weather. The Team was told that the original estimate of the area to be benefited was wrong and that the culturable area actually commanded was much less and included groves, orchards and grass-lands, which ordinarily do not need any irrigation, average rainfall being between 50" to 60".

2.61. The actual operational and financial performance of the scheme for the last three years is reported to be:—

Year	Annual irrigable commanded area	Actual irrigation				Assessment				M&R Exp.
		Kharif	Rabi	Hot weather	Total	Kharif	Rabi	Hot weather	Total	
		Acres				Rs.				
1962-63	1900	1400	..	16	1,416	14000	..	288	14,288	4,100
1963-64	..	520	52	6	578	5200	260	108	5,568	5,025
1964-65	..	580	..	5	585	5800	..	90	5,890	4,000
Total		2500	52	27	2,579	25000	260	486	25,746	1,3125
Average		833	17	9	859	8339	87	162	8,582	4,375

2.62. Study of the actual utilisation of the project potential created in 1957, on which development of irrigation should have long since been achieved presents a poor picture. The performance in *rabi* and hot weather crops is really disappointing, the three years average under review being only 26 acres against 500 acres envisaged. The overall average annual utilisation of 859 acres is just 53 per cent of the target of 1,700 acres. Effective cost per acre on this performance thus comes to Rs. 1,106 which is almost three times of the original estimation. One of the reasons for this poor utilisation was stated to be the seepage effect of storage on the subsoil water level in the command. The S.S.W.L. was reported to be rising rendering some fields waterlogged while others could now do without any irrigation.

2.63. As for the financial performance of the project, average annual return to the State Exchequer in the form of water rates for the 3 years under review comes to Rs. 8,582. Annual maintenance and repairs expenditure works out to Rs. 4,375. There is thus an annual net revenue of only about Rs. 4,200, *i.e.*, only 0.45 per cent return on capital expenditure against a minimum rate of 4½ per cent which an irrigation project should normally pay. This loss is there even when the other legitimate charges of overhead expenditure are ignored. This project, which right from the very inception is with the Irrigation and Waterways department, should have yielded encouraging results compared to those which after execution are made over to the Panchayats for operation and maintenance.

2.64. Bucha-Opa project lies in an annual rainfall zone of 50 to 60 inches. Its utilisation in *kharif* can thus be of only a supplementary nature. The conserved supplies could, however, be put to more effective use for *rabi* and hot weather irrigation. When the percentage of irrigated area over the total cropped area in Chhotanagpur Plateau is about 8, there is all the more reason to concerted efforts being made to achieve effective utilisation of the projects. The Agriculture Department in co-ordination with the Irrigation



Department may evolve and propagate suitable cropping pattern and create an urge for rabi and hot weather irrigation amongst the cultivators so that the project may prove beneficial to the area and may be able to pay its way.

### Schemes Executed under the Bengal Irrigation Act, 1876

**2.65.** Besides Lotia and Bucha-Opa Minor Irrigation works visited by the Team, there are another 14 Plan period works costing individually up to Rs. 15 lakhs constructed under the Bengal Irrigation Act, 1876, in the charge of Irrigation and Waterways Department on which assessment of water rates and booking of irrigation is done. Data with respect to their performance supplied by the State authorities is given in *Appendix IV*.

**2.66.** Annual average irrigation from 1962-63 to 1964-65 on these 16 works comes to 27,913 acres against annual target of 44,090 acres. Percentage of utilisation thus comes to 64. On some individual works, however, utilisation is less than 25 per cent even.

**2.67.** M. & R. expenditure has been made available with respect to 9 schemes given at serial No. 1 to 9 of *Appendix IV*. Financial picture emerging from the study of these 9 works is as under:—

	Rs.
Average annual Assessment	86,975
Average annual M & R Expenditure	50,254
Surplus of assessment/M&R Expenditure	36,721
Interest at 4.5% on capital cost of Rs. 40,52,000	1,82,340
Annual Deficit	1,45,619

**2.68.** With such operational and financial performance of the works under the expert management of the Irrigation and Waterways Department, utilisation may be far less on the works which after execution under the Bihar Private Irrigation Act, 1922, are transferred to the Gram Panchayats for operation and maintenance, with little or no technical assistance available with them. The latter type of works form the bulk of the State's minor irrigation potential. In absence of any physical recording of irrigation thereon their actual serviceability cannot be judged.

**2.69.** To get the desired results, it seems necessary to evolve suitable procedure to ensure their proper maintenance and upkeep. Responsibility need be fixed on the local officers of the Minor Irrigation Department to conduct periodic inspections of the works in their jurisdictions. Works which due to inadequate maintenance by the beneficiaries or the village agencies have fallen in disrepair may be attended to under Sections 3, 4 and 5, and if necessary, 36-A of the Bihar Private Irrigation Works Act, 1922.

**2.70.** There is apparently no uniform policy in respect of small irrigation works with regard to their maintenance, upkeep and assessment of areas benefited. It would seem advantageous if all such schemes are brought under a unified Code so that rules and regulations could be enforced by the authorities effectively. That will eventually result in better performance of these works leading to greater agricultural production than what has been possible so far.

## CHAPTER III

### AHARS AND PYNES

**3.1.** In Bihar most common type of minor irrigation works are the Ahars and Pynes, which were constructed wherever feasible by the erstwhile zamindars to protect their paddy areas against small duration droughts. There are thousands of these works spread all over the State and they are there for centuries. With the abolition of zamindari they vest in the beneficiaries. In some cases, where they are of fair dimensions capable of benefiting substantial areas, they have since been renovated by the State, at the request of the beneficiaries, with minor irrigation grants. Most of the 2.05 million acres being irrigated in the State from other sources (Table 1.5 Chapter I) is actually irrigated by innumerable Ahars and Pynes.

**3.2.** Ahars are generally contour bunds. They accumulate water either from small local catchments, mostly consisting of paddy fields, or from small local drains across which small diversion regulators or earthen bunds are put. The Ahar bund is provided with a few pipe outlets, which are opened when the areas downstream of the ahars need artificial irrigation. The outlets very often start direct field to field irrigation from their very heads but sometimes when the commands are extensive, the water released through the outlets is carried through field channels which are locally known as Pynes. The diversion channel from drains to the Ahars are also known as Pynes.

**3.3.** During its field visits the Team saw a few Ahars and Pynes also. Brief observations thereon are contained in the following paragraphs. Figure 3.1 shows their approximate locations.

**3.4. Malaur Ahar** is situated in village Malaur, district Shahabad, 17 miles from Arrah on Arrah—Sasaram road. This is an old ahar renovated in the year 1958 at an expenditure of Rs. 29,972 against a sanctioned estimate of Rs. 34,234. The work consisted of repair to ahar bund, embankment, and the construction of a 7.5 ft. high masonry regulator of 7 spans of 5 ft. each. Previously an improvised obstruction to divert water to the ahar used to be put at this place. Area under submergence in the ahar is reported to be 40 acres.

**3.5.** The project is located in an annual rainfall zone of about 39 inches. Water table in a well close to the weir was found to be about 5ft. below ground level. It was stated that it drops further by about 3 ft. in winter months.

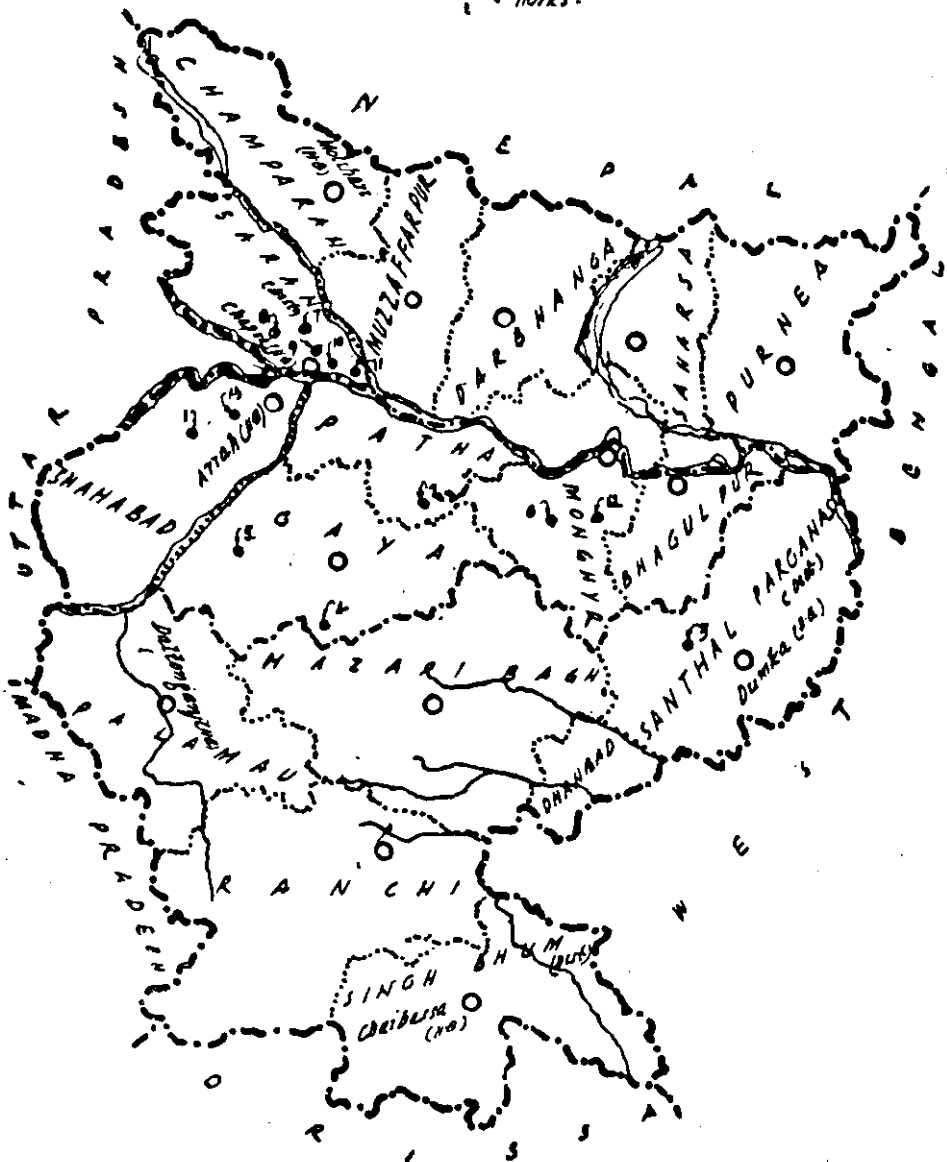
**3.6.** The project was intended to command an area of 1,000 acres. But area as being irrigated is stated to be 800 acres *khari* (paddy) and 100 acres *rabi*. No recording of actual irrigation is done.

**3.7.** This is a non "Fard-ab-Pashi" scheme constructed on 50 per cent subsidy basis under the Bihar Private Irrigation Works Act, 1922. After completion the project was transferred to the Gram Panchayat for operation and maintenance. However, no recovery towards the cost of construction has so far been effected from the beneficiaries. The State has also not incurred any expenditure on it after its renovation in 1958. Naturally the bund of the ahar needs repairs and strengthening. Channel taking off from the ahar also needs proper maintenance and improvement.

- LEGEND -

- International Boundary ————x———x———x
- State Boundary ————x———x———x
- Zonal Boundary ————x———x———x
- District Boundary ————x———x———x
- District Headquarter ○
- Works .

MILES 0 10 20 30 40 50 60 70 80 90 100



Ref. No.	Name of Works	District	Ref. No.	Name of Works	District
1.	Malaur Ahar	Shahabad	7.	Naini Pyne	Saran
2.	Nagari Ahar	Patna	8.	Barhampur Pyne	Saran
3.	Sabajore M. I. Project	Santhal-Parganas	9.	Khanua Nala No. 1 & No. 2	Saran
4.	Dhardhari Irrigation Project	Gaya	10.	Bishunpur M. I. Scheme	Saran
5.	Itkoh Ahar	Gaya	11.	Mira Mushahri M. I. Scheme	Saran
6.	Chandra Ahar	Monghyr	12.	Sikandra Ahar	Monghyr
			13.	Kasap Ahar	Patna.

FIG. 3.1—Map of Bihar State showing locations of Ahars & Pynes visited by the team.

3.8. There were some complaints of inequitable apportionment of water at site. The State authorities will undoubtedly look into them. But it appears that outlet ventages and locations are not fixed scientifically. This should be done in the interest of equitable distribution and optimum utilisation of the available supplies.

3.9. Nagri Ahar is located in village Lahuar (Rajgir), P.S. Silao, District Patna. It is an old irrigation work. It has been renovated and improved by the Minor Irrigation Department of the State in 1961 at a cost of Rs. 30,085. The tank is flanked by hills on two sides. It has a catchment of 1 sq. mile with average annual rainfall of 40 inches. The original bund did not have sufficient escape provision with the result that it breached frequently. The renovation of the Ahar besides earthwork on the bund included provision of a 50 ft. long masonry weir of 5 ft. height, fitted with 3 nos. under sluices 3' × 2' each, 5 nos. hume pipe outlets of 1 foot diameter for the five pynes and construction of a 5' × 4' separate under sluice in the *bund* for speedy draining out of the ahar, whenever required. A corresponding culvert under the *pucca* road running parallel to the bund, however, still remains to be constructed for the 5' × 4' under sluice.

3.10. The ahar is estimated to irrigate about 1,000 acres of paddy every *kharif*. There is no recording of irrigation. The area actually being benefited is, therefore, not known. The general condition of the pynes appeared poor. Evidently the beneficiaries do not carry out proper annual repairs and clearances. Consequently an appreciable amount of water must be going to waste. The outlets in the ahar bund are all of a uniform size of one foot diameter without any consideration of the area on each pyne and its level. This may also cause waste and inequitable distribution of water. The state authorities have informed that earliest action will be taken with regard to fixation of out-lets of required sizes.

3.11. This is a "Fard-ab-pashi". As such the beneficiaries are entitled to free irrigation under the existing practice. How far this is justified, especially when no free labour is provided by them now, as they used to do in pre-zamindari-abolition days, needs to be considered\*. Works like these do need some technical supervision and maintenance which ordinarily cannot be done by beneficiaries themselves. It may be in their larger interest if big ahars like this are maintained by the State and an annual charge is levied on the commanded area.

3.12. Sabajore M.I. Project.—This ahar is located 23 miles from Deoghar in village Sabajore P.S. Sorath, district Santhal Parganas. This is an old ahar renovated by the Minor Irrigation Department in 1963 at an estimated cost of Rs. 15,372 to irrigate 192 acres of paddy area.

3.13. The local catchment of about half a square mile has been held up with 2.150 ft. long and 9 ft. high earthen bund. A clear overfall weir of 13 ft. length, designed to pass 4.5 ft. maximum flood depth has been constructed. Irrigation is done field to field direct through the hume pipe outlets provided in the *bund*.

3.14. Sabajore project is also a "Fard-ab-pashi" scheme. No water rates are levied. The ahar is reported to have irrigated 192 acres in *kharif* 1963-64. No recording of irrigation is done.

3.15. Irrigation water is applied to *kharif* paddy. Wheat also follows paddy in patches, where there is adequate moisture after paddy harvesting.

\*The state authorities have informed that the "Fard-Ab-pashi" rights have since been frozen and those schemes would stand at par with other schemes.

**3.16.** During the erstwhile *Zamindari* system the old Sabajore ahar is stated to have yielded an income of about Rs. 500 annually, as fishing lease. At present neither the State nor the Panchayat is leasing it out for fishing. Since, after completion such type of works done under the Bihar Private Irrigation Act, 1922, are given over to the *Gram Panchayats* for operation and maintenance, State Government or the Panchayat could justifiably collect fishing lease money. This point needs to be examined.

**3.17. Dhardhari Irrigation Projects.** -*En route* Hazaribagh to Gaya the team visited Dhardhari irrigation scheme. It is an old ahar with considerable capacity. On the improvement of its pyne an expenditure of Rs. 40,000 is stated to have been incurred. During *kharif* 1964 the scheme is stated to have irrigated 6,000 acres of paddy crop. However, no details of the scheme could be made available to the Team. It is understood that a proposal to have a regular diversion weir on the stream concerned and to remodel the pyne into a regular canal likely to cost Rs. 3.5 lakhs, is under scrutiny with the authorities concerned.

**3.18. Itkoh Ahar** lies in Madanpur Block of district Gaya. It is an old ahar, which used to be fed by putting in *kacha bund* in the drainage to divert its water. This limited its utility and added to annual maintenance expenses. In the year 1955, the Agriculture Department with an expenditure of Rs. 18,120 carried out improvements in the *bund* and constructed a masonry weir to divert the water into the ahar. Length of the bund is about 7,200 ft. The project is stated to be irrigating about 1,000 acres paddy area.

**3.19.** Since the maintenance of the scheme is not with the Government no expenditure has been incurred on it after renovations. The bund was found in neglected condition needing immediate strengthening and raising. The efficiency of irrigation works can be ensured only if they are kept in good condition.

**3.20. Chandra Ahar** is located in village Aghara of district Monghyr. It is fed by a local catchment of 1/5 sq. mile, in an average annual rainfall zone of about 35". It is an old "Fard-ab-pashi" scheme and has been renovated recently at the request of the beneficiaries. The renovation is estimated to cost Rs. 18,623 and includes earthwork for repairs of the ahar bund and construction of a 15 ft. long weir and a regulator. The ahar is estimated to provide annual irrigation to about 700 acres of paddy area. Rabi is also cultivated in some patches where there is ample moisture after paddy harvesting.

**3.21.** The renovation work was completed in 1962-63. Roughly 200 acres paddy area is stated to have been irrigated by the scheme in 1963-64, the first year of its operation after renovation. Irrigation takes place from direct outlets in the ahar. There are no field channels and watercourses. Outlets are fixed on *ad hoc* basis without much consideration of the extent and levels of their commands. As the accounts of the work have not yet been finalised, the ahar is still with the Minor Irrigation Department. It will be handed over to beneficiaries after closing its account.

**3.22. Naini Pyne.**—In the year 1954-55 desilting of Naini pyne and construction of a masonry regulator was carried out at a cost of Rs. 12,124. The scheme serves a dual purpose of providing irrigation by diverting the inflow of a drain and also of protecting the areas upstream of the regulator from flooding by the back water into the drain.

**3.23.** The area commanded by the Naini Pyne is reported to be 2,000 acres. The regulator and the pyne both appeared to be in a badly neglected condition. Even the regulator planks were missing, which were stated to have been washed away during previous floods. No idea could be had from the Minor Irrigation staff regarding actual performance of the scheme. In fact, they have not got even full details and other particulars of the scheme as it was executed by the Agriculture Department and now it is supposed to be the responsibility of the beneficiaries.

**3.24. Barhampur Pyne** scheme in village Barhampur P.S. Chapra is another irrigation-cum-flood protection scheme, similar to Naini Pyne, constructed by Agriculture Department in 1954-55 at a cost of Rs. 26,718. Its maintenance is also badly neglected. The scheme is supposed to benefit 700 acres but actually it may not be doing much. Nobody appears responsible for its operation and maintenance.

**3.25. Khanua Nala No. 1 and Khanua Nala No. 2** are the drainages of Chapra Town into Sarju river. Desilting of the nalas was done in the year 1953-54 and 1952-53 at costs of Rs. 25,941 and Rs. 12,883 respectively. The schemes were shown as benefiting 3,000 and 2,000 acres respectively. The nalas run through Chapra town and serve the purpose of the city drainage apart from evacuating accumulated water of Chauris. The regulators prevent back watering of the river into the town. The schemes were executed by Agriculture Department under minor irrigation, although they do not seem to serve any minor irrigation interests. The nalas appear to have again silted up.

**3.26. Bishunpur Scheme.**—This is an old small pyne from river Chagra a few miles upstream of its confluence with Ganga. It is provided with a screw gate at its head. The water through the pyne goes to Shukhan Bandis. The bund was renovated in 1951-52 at an expenditure of Rs. 22,666 by the Agriculture Department. The scheme is supposed to benefit 2,500 acres. At present the screw gate is not functioning properly and the pyne is silted up. The abutments of the head regulator had developed cracks. No silt clearance of the channel was done since about 10—12 years. To get the best advantage of the projects it is necessary to keep them in good working condition. It is possible only, when they are made somebody's responsibility.

**3.27. Chirand Pyne in village Chirand and Drigang P.S. Chapra.**—This is another scheme where renovation of an old pyne was done in the year 1950-51 through Agriculture Department. Expenditure incurred was Rs. 19,052 and the area reckoned to be benefited is stated to be 2,000 acres. Like other similar scheme, this too did not appear to be receiving much attention from the beneficiaries.

**3.28. Mira Mushahari M.I. Scheme.**—The scheme completed in July 1964 lies in village Mira Mushahari, P.S. Chapra Muffasil, district Chapra. Total estimated cost of the project is Rs. 28,236 which includes earthen repairs of pyne and masonry construction of the work on the scheme 2 sq. miles is the catchment area of the scheme and 44 inches the average annual rainfall of the zone.

**3.29.** Out of the gross area of 550 acres on the scheme, commanded area is 425 acres. Cost per acre works out to about Rs. 62. Irrigation is effected by heading up of water after closing the shutter fitted on an existing

village channel. Some lift irrigation is also effected from the scheme through light manual lift. Approximately 100 acres area (60 acres in *kharif* and 40 acres in *rabi*) is stated to have been irrigated in the year 1964-65. How far can the project achieve its target to irrigate 425 acres could be seen only on its full development.

**3.30.** Keys for operation of the shutter have since been handed over to the Panchayat and the project is to be formally transferred to it on finalisation of its accounts. The scheme has been taken up under the Bihar Private Irrigation Works Act, 1922, and 50 per cent of the cost is recoverable from the beneficiaries.

**3.31. Sikandra Ahar.**—This ahar near Jamui-Sikandra road was stated to have been built by Agriculture Department some six years back at considerable expense. In the very first floods after its construction the weir foundations were undermined and the entire superstructure collapsed. Since then no attempt was made to reconstruct the work. It is understood a few other masonry structure constructed by the Agriculture Department have also met the same fate.

**3.32. Kasap Ahar Scheme.**—The scheme is situated at 7th mile from Arrah on Arrah Sasaram road. It is an old ahar with a catchment of 1 sq. mile located in an average annual rainfall zone of 39 inches which was renovated in 1957. Estimated cost of repairs to ahar bunds, embankment and two span sluice masonry regulator was Rs. 12,961. Actual expenditure incurred on it is stated to be Rs. 11,929.

**3.33.** The project is reported to be irrigating 1000 acres annually (*kharif* 900 acres and *rabi* 100 acres). Since no recording of irrigation is done at site, the reported figures appear only a guess.

**3.34.** Kasap Sub-distributary of Sone Canal has passed through the command of Kasap ahar. The area intercepted by the sub-distributary is now receiving irrigation from the perennial canal system and is being assessed to water rates whereas the other area fed by Kasap ahar receives free irrigation.

**3.35.** In the command of Kasap ahar a tubewell (in 10 inches casing) was seen being sunk on subsidised basis for the area of Shri Satindar Prasad Singh a leading *zamindar* of village Kasap. Boring done up to 195 ft. was stated to be held up for more than six months since July, 1964, as hard soil had been encountered. Rotary plant for further boring had been requisitioned and was awaited.

**3.36.** Provision of perennial irrigation from Sone canal system in a portion of the command of Kasap ahar, and in another small portion from a subsidised tubewell is no doubt an improvement upon the original provision from the ahar. But it is to be seen that providing overlapping sources in the command which is already catered for, does not deprive other deserving cases from receiving their due priority.

**3.37.** Though the Team visited only a few ahars and pynes, yet in districts of Gaya, Bhagalpur, Monghyr, Santhal Parganas and Shahabad, there are a large number of small irrigation resources of this type. Cumulatively they may be serving an area of approximately two million acres. Their maintenance, by and large, is poor. There is, therefore, a drop in their yearly performance efficiency. This is a matter of concern. Some

suitable machinery needs to be evolved, so that this age old practice of securing irrigation at a low capital cost is kept up at a good level of performance efficiency.

**3.38.** Possibly, a regular irrigation charge will help, an yearly assessment being made of the performance of individual works. A drop in assessment may thus bring to light the deficiencies and will enable attention being given to them.

**3.39.** Another helpful step may be a periodic inspection scheme being laid down for Irrigation Department officers at different levels to make routine periodic inspections of all such works and advise the agencies responsible for maintenance and up-keep to cause necessary action in time.



## CHAPTER IV STATE TUBEWELLS

4.1. Besides small irrigation works like tanks, local canals, ahars and pynes etc. there are also a good number of State tubewells in Bihar. A start to provide irrigation tubewells was made in the State in early forties. It, however, received an impetus during the first Five Year Plan period. The total number of State tubewells at present is 974 as shown hereunder:—

Pre-Plan State tubewells . . . . .	180
State tubewells constructed in First Plan (1951-56) . . . . .	767
State tubewells constructed during II & III Plans . . . . .	27
	974

4.2. Out of these 974 State tubewells, 529 lie in South Bihar and 445 in North Bihar. They all are designed to a capacity of discharging about 1.5 cusecs (34,500 gallons per hour). Map at figure 4.1 shows State tubewell areas. Those visited by the Team are also listed on the Map.

### District-wise Distribution.

4.3. The district-wise distribution along with the irrigational performance of the tubewells is given in the following Table 4.1.

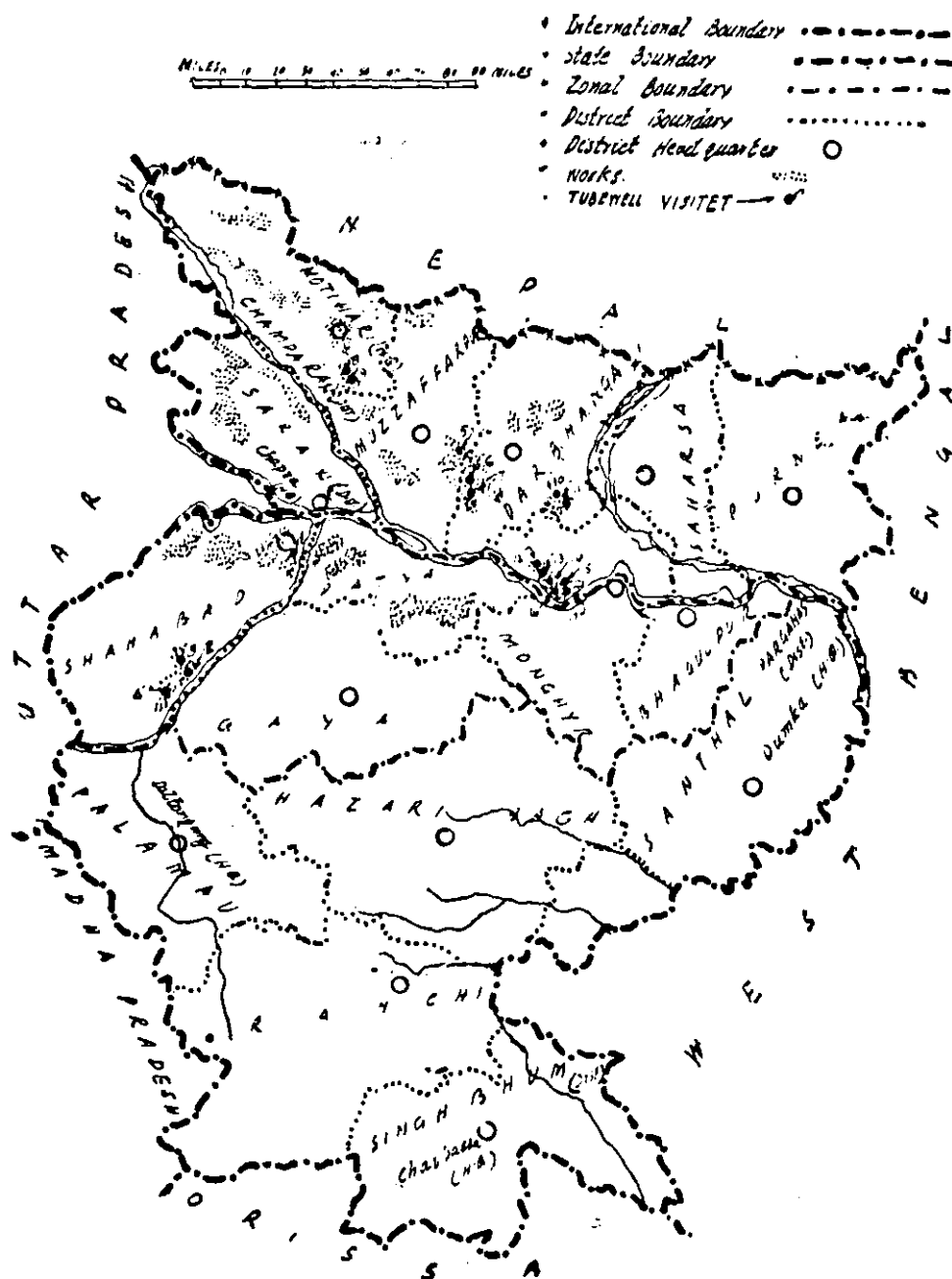
TABLE 4.1 (In Acres)

District	No. of T.W.	Actual Irrigation			Total	3 Yrs. average	Average per T.W.
		1961-62	1962-63	1963-64			
Muzaffarpur . . . . .	81	8774	5893	4250	18917	6306	78
Darbhanga . . . . .	164	7105	11963	8019	27087	9029	55
Saran . . . . .	97	8873	11179	7922	27974	9325	96
Champanan . . . . .	103	12616	8839	10189	31644	10548	102
<i>Total North Bihar</i>	445	37368	37874	30380	105622	35207	79
Shahabad . . . . .	276	63759	72968	73101	209828	69943	253
Patna . . . . .	232	48937	58693	56644	164274	54758	235
Monghyr . . . . .	18	2971	3974	394	10890	3630	202
Gaya . . . . .	2	18	166	309	495	165	55
Bhagalpur . . . . .	1	53	..	232	285	95	95
<i>Total South Bihar</i>	529	115738	135801	134231	385760	128587	243
<b>TOTAL SOUTH BIHAR</b>	<b>974</b>	<b>153106</b>	<b>173675</b>	<b>164611</b>	<b>491382</b>	<b>163794</b>	<b>168</b>

4.4. State tubewells were originally expected to irrigate 400 acres each in North Bihar (Hot weather 100 acres, *Kharif* 100 acres and *Rabi* 200 acres) and 450 acres per tubewell (H.W. 100 acres, *Kharif* 150 acres and *Rabi* 200 acres) in South Bihar.

4.5. In 1959, these targets were reduced to 300 acres and 350 acres per tubewell in North and South Bihar respectively.

## LEGEND:-



Sl. No.	Name of Tubewell	District	Sl. No.	Name of T. W.	District
1.	Kaimnagar No. 16	Shahabad	10.	Harpur Alloth	Monghyr
2.	Bardiha	Do.	11.	Mohanpur No. 10	Do.
3.	T.W. No.11 Nawadih I	Do.	12.	Sograha	Do.
4.	Katar No. 3	Do.	13.	Malti	Do.
5.	Pusa Farm T. W.	Muzaffarpur	14.	Singdoha	Do.
6.	Bhagwanpur Desua	Darbhanga	15.	Bihat South East	Do.
7.	Hansa T.W.	Do.	16.	Papraur	Do.
8.	Barmodia	Champaran	17.	Mohammadpur	Do.
9.	Chakia	Do.	18.	Raghu Nath T.W.	Do.
				Harakh T.W.	Do.

FIG. 4.1.—Map of Bihar State showing tubewell areas and locations of the tubewells visited by the Team.

4.6. A study of the figures in Table 4.1, however, shows that the actual performance is far below even the lowered targets, the average being only 79 acres for North Bihar tubewells (*i.e.*, 27% of the lowered target) and 243 acres for South Bihar (*i.e.* 70% of the lowered target).

4.7. Further analysis of the North Bihar tubewells figures for 1962-63 has shown that out of 445 tubewells there, as many as 43 irrigated even less than 10 acres each, 128 did less than 30 acres, 201 less than 50 acres and only 70 irrigated more than 150 acres each.

4.8. Neither the district-wise crop-wise irrigation figures per tubewell nor average running hours could be had from the authorities concerned. However, the following figures for various tubewell divisions for 1963-64 could be gathered :—

(In acres)

Name of Divn.	No. of T.W.	Av. running hours per T.W.	Average Crop wise irrigation per T.W.							
			Vegetables	Sugar-cane	Paddy	Maize	Rabi Cereals & Pulses	Potato	Misc.	Total
<i>South Bihar</i>										
Arrah L. I. Division	275	2880	8	27	139	—	103	8	—	285
Patna „	253	1869	46	9	117	—	56	15	1	244
<i>North Bihar</i>										
Muzaffarpur Division	81	295	—	18	8	2	7	2	4	41
Samastipur Division	131	184	1	2	2	5	22	1	4	37
Saran (Chapra) Division	97	542	31		33		45			109
Champaran (Motihari) Div.	103	791	37		45		17			99
Jhanjharpur Division	33	496	55		48		6			109

### Water Consumption

4.9. As it has not been possible to obtain actual average yields of tubewells in different districts or divisions, nor the running hours by crops and seasons, the quantity of water used per watering for various crops and the number of waterings actually being applied is, therefore, uncertain. The average running hours per acre of irrigation in each division, however, work out as below :—

*Average running hours per acre irrigated*

Arrah T.W. Divin.	10.1
Patna T.W. „	7.66
Muzaffarpur „	7.20
Samastipur „	5.00
Chapra „	4.97
Motihari „	8.00
Jhanjharpur „	4.55

Assuming average discharge per tubewell to be 1.5 cusec, the depth per hour per acre including losses will be roughly 1.5 inches.

4.10. The assessment on tubewells in Bihar at present is based on acreage basis. *Appendix V* contains a copy of the schedule of irrigation rates on tubewells and E.R.P. sets in force. The cultivator under the system naturally has no incentive to use the water economically and to put it to optimum use.

4.11. The field inspections showed that generally the lands were not levelled by the cultivators and it appears they must be using 6" to 7½" depth per watering (including the losses in field channels etc.). Thus the areas being irrigated from tubewells appear to be receiving on an average 2 waterings in Arrah Division, 1½ watering in Patna, Muzaffarpur and Motihari divisions, and only one watering in Samastipur, Chapra and Jhanjharpur Divisions.

4.12. From the data contained in the above paragraphs it appears that construction of tubewells in Bihar has not had any marked effect on development of cash crops except in Patna Division, where tubewell irrigation seems to be used extensively for vegetable growing and in Arrah and Muzaffarpur where sugarcane, though not on any extensive scale, is being irrigated from tubewells.

4.13. In South Bihar tubewell water is also being used on a limited scale for foodgrains, e.g., paddy and *rabi* cereals etc., while in North Bihar even that use is also practically non-existent. This is in spite of the fact that the irrigation is charged on acreage basis, and the rates are extremely low, probably the lowest in the country. Apparently extensive effort is urgently needed to be mobilised on the areas served by tubewells.

### Trends of Development

4.14. As stated earlier the tubewells in Bihar were mostly built during First Plan period (1951-56). Yearly progress of irrigation per tubewell in the two zones viz., north and south since 1956-57 is given in Table 4.2. It also shows the average annual rainfall in inches. The Table does not indicate any clear trend of gradual development of irrigation or possibility of any marked increase in utilisation in the near future.

TABLE 4.2

Year	North Bihar		South Bihar	
	Average irrigation per tubewell (acres)	Rainfall in inches	Average irrigation per tubewell (acres)	Rainfall in inches
1956-57	15	59.50	97	51.68
1957-58	130	39.20	275	31.69
1958-59	73	52.33	245	47.84
1959-60	110	39.93	251	47.26
1960-61	131	47.42	260	43.15
1961-62	85	37.00	221	54.60
1962-63	95	47.02	296	38.36
1963-64	76	56.76	230	43.81

**4.15.** The uneven distribution of rainfall may be having some marginal effects on the demand for irrigation. The soil, climate and rainfall etc. are evidently such that most of the crops can mature without irrigation and as such the role of irrigation, particularly in North Bihar and even in South Bihar except for vegetables and sugarcane, is only of a supplemental nature. This ready at hand irrigation potential as tubewells provide can be utilised, if suitable changes in cropping patterns are introduced.

**4.16.** One cause for poor utilisation especially in North Bihar may be imperfectly applied land policy of the State. Though zamindari has been officially abolished in the area, yet in actual practice it is gathered that the actual cultivator very often is not the owner of the land he tills.

#### **Comparison with adjoining districts of U.P.**

**4.17.** For the sake of comparison in *Appendix VI* is shown performance of tubewells in north-eastern districts of U.P. viz., Gorakhpur, Basti and Deoria which adjoin Bihar for 1963-64. *Appendix VII* gives crop-wise area irrigated per tubewell on different groups in Gorakhpur District. These tubewells too serve almost analogous areas with clayey lands, heavy rainfall and humid climate like those of North Bihar. But the performance there, though not up to the mark, is better. Evidently this difference is due to some operational factors.

**4.18.** Usually sufficient length of lined and unlined water courses has been provided on tubewells both in North and South Bihar and more is being added gradually. As far as could be ascertained the development of irrigation is not seriously held up for lack of distribution system but mainly for want of incentive and interest on the part of irrigators.

#### **Individual wells**

**4.19.** In respect of wells visited by the Team, in North and South Bihar their individual performance is shown in Tables 4.3 and 4.4.

TABLE 4.3  
North Bihar

(Area in acres)

Sl. No.	Name of the district & tubewell	Discharge G.P.H.	1961-62				1962-63				1963-64				Maximum possible* Assessment (Rs.) (Average from 1961-62 to 1963-64)
			H.W.	K.H.	RABI	Total	H.W.	K.H.	RABI	Total	H.W.	K.H.	RABI	Total	
<i>Muzaffarpur</i>															
1.	Pusa Farm . . .	N. A.	90	32	144	266	70	32	112	214	51	45	121	217	2,185
2.	Bhagwanpur Desua . . .	N. A.	77	72	39	188	93	6	54	153	39	41	25	105	1,992
3.	Hansa . . . . .	N. A.	18	6	2	26	10	..	6	16	3	..	1	4	205
<i>Champaran</i>															
1.	Chakia . . . . .	35,400	35	19	8	62	30	17	12	59	81	8	11	100	982
2.	Barmodia . . . . .	35,400	24	48	..	72	4	39	15	58	40	18	6	64	665
<i>Darbhanga</i>															
1.	Harpur Alloth . . . . .	N. A.	16	..	..	16	6	5	1	12	2	..	..	2	146
2.	Mohanpur . . . . .	N. A.	3	5	..	8	1	..	..	1	1	..	..	1	40
<i>Monghyr</i>															
1.	Sograha . . . . .	N. A.	1	..	1	2	1	..	71	72	..	4	32	36	194
2.	Malti . . . . .	N. A.	3	..	4	7	1	..	46	47	5	1	48	54	216
3.	Singdoha . . . . .	N. A.	3	1	21	25	..	..	49	49	5	..	70	75	281
4.	Bihat S. E. . . . .	N. A.	..	..	..	..	..	..	11	11	2	..	26	28	73
5.	Papraur . . . . .	N. A.	..	..	5	5	..	..	83	83	..	..	54	54	237
6.	Md. pur Raghu Nath . . . . .	N. A.	4	1	29	34	..	..	47	47	..	..	40	40	218
7.	Harakh . . . . .	N. A.	1	4	47	52	3	..	40	40	5	..	23	28	244
AVERAGE			20	13	21	54	16	7	38	61	17	8	33	58	540

\*This is based on the assumption that each irrigated field received at least 3 waterings.

TABLE 4.4  
South Bihar

(Area in acres)

Sl. No.	Name of the district & tubewell	Discharge G. P. H.	1961-62				1962-63				1963-64				Actual Assessment (Rs.)
			H.W.	K.H.	RABI	Total	H.W.	K.H.	RABI	Total	H.W.	K.H.	RABI	Total	
<i>Shahabad</i>															
1.	Kaim Nagar No. 16	40,000	60	125	185	6	62	160	228	11	76	149	236	1954 (Actual average 1960-61 to 1962-63)	
2.	Bardiha	38,400	49	107	140	296	49	145	170	364	68	237	298	603	7059 (1963-64)
3.	Nawadih I T.W. No. 11	42,000	135	204	220	559	85	233	205	523	36	208	165	409	3804 (1963-64)
4.	Katar No. 3	34,500	68	117	210	395	67	142	218	427	35	140	202	377	3335 (1963-64)
AVERAGE		3,870	63	122	174	359	69	146	188	403	38	165	204	407	4038

4.20. Table Nos. 4.3 and 4.4 also confirm the conclusions drawn earlier from overall performance of State tubewells in the North and the South Bihar.

4.21. On North Bihar tubewells the Hot weather and *Kharif* irrigation is by and large negligible and the *rabi* irrigation is generally between 25 and 50 acres.

4.22. In South Bihar the Hot weather irrigation average of the Tubewells visited is 57 acres, *Kharif* 144 acres and *Rabi* 189 acres. The tubewells in South Bihar have evidently better performance than those in North Bihar. As it happened the Team was taken mostly to better type of wells in South Bihar.

Condition of water courses both lined and unlined in South Bihar was mostly satisfactory. But in North Bihar they looked neglected and were either full of weeds and silt or at places lying breached for lack of interest on the part of the cultivators. The fields too are more uneven in North Bihar than in South Bihar.

4.23. The operators usually could not give sufficiently detailed information about the irrigation on tubewells in their charge. Their records were mostly incomplete. Generally they did not appear to have full time work. Further it was noticed that each operator had one mate under him, who too was evidently not doing much.

4.24. The tubewells very often are not provided with any approach service roads connecting them to the main roads. As such they cannot be inspected as frequently as they should be, by the touring officers.

#### FINANCIAL ASPECT

4.25. According to the information supplied for 1963-64, the "gross revenue" from the 974 State tubewells was Rs. 14,11,263 only while the working expenses on them for the year were Rs. 42,42,783 *i.e.*, Rs. 1,449 and Rs. 4,356 per tubewell respectively. The net annual loss was thus Rs. 28,31,520 or Rs. 2,907 per tubewell.

4.26. Most probably these figures do not include the establishment charges. They also do not include the interest on capital. The capital cost of the 974 tubewells is reported to be Rs. 4.8 crores *vide* scheme-wise details in *Appendix VIII*. Even if a minimum of 4.5% interest is reckoned on the capital it amounts to Rs. 21.6 lakhs annually.

4.27. Assuming annual expenditure of above Rs. 10 lakhs on establishment, the total annual loss on the tubewells adds to Rs. 59.92 say 60.0 lakhs or about Rs. 6,160 per well or Rs. 36.5 per acre irrigated. If these figures were worked out for the North and the South Bihar tubewells separately, they will probably be more than Rs. 80 per acre for North Bihar and about Rs. 25 per acre for South Bihar tubewells. The loss being incurred by the State Electricity Board for supplying electricity at reduced rates will be in addition.

4.28. Besides other steps indicated above to improve the performance of State tubewells in Bihar, it appears there may also be room for economy in the maintenance cost of the tubewells. The overall cost of maintenance and repairs per tubewell in Bihar is reported to be Rs. 1,292 (excluding electric charges). The corresponding figure for U.P. State tubewells is only



Rs. 650 per tubewell for those running more than 3,000 hours and Rs. 500 per tubewell for those running up to 2,000 hours annually. The disparity is glaring and needs looking into. The provision of work-charged mates on tubewells to assist operators is one such item which the Team feels could easily be done away with. No such facilities are provided to operators in U.P. even though the tubewells there have to run for greater number of hours.

**4.29.** Bihar is comparatively a heavy rainfall area. Provision of State tubewells merely for supplemental irrigation purposes, on only a protective basis, have proved highly unwholesome financially, more particularly in North Bihar. On the whole, however, tubewells do provide a ready at hand irrigation source with plenty of supplies from ground water resources. If intensive agriculture develops in tubewell areas in Bihar, tubewells could yield a handsome return on investments made.

**4.30.** In its turn it may also lead to a better financial return to the State, if supply of water is made to the irrigators on a rationalised basis of volumetric sale of water. That will also enable irrigated agriculture being developed on scientific basis, as it should in areas served by tubewells. State tubewells as potential units of scientifically planned irrigated agriculture thus require specific attention on the part of the State Agriculture authorities.

## CHAPTER V

### SURFACE WELLS AND LIFT IRRIGATION

**5.1.** Wells in Bihar State contribute 16.81 per cent towards irrigated agriculture against 29.50 per cent for the entire country. This may apparently be due to the fact that in the Chhotanagpur plateau with area of 27,292 sq. miles out of a total of 67,196 sq. miles of the State, the soil is mostly rocky where irrigation wells are difficult to construct, involving heavy expenditure and low dependability.

#### **Plan Progress**

**5.2.** Before the Plan period there were 1,10,700 surface percolation wells in the State. During the First and Second Plan periods 60,713 surface wells were added. The State planned to further add 14,613 surface wells in the Third Plan period out of which 3,135 only were completed up to 1963-64.

**5.3.** Besides these the States have embarked upon an ambitious programme of open borings with and without strainers. Their pre-Plan number was 2,554. An addition of 16,412 was made during the first two Plans. In the Third Plan 648 open borings with strainers, and 10,350 without strainers were envisaged. Their number actually executed up to end of 1963-64 is stated to be 1,025 and 3,951 respectively *i.e.*, 4,976 only against a target of 10,998 for the Third Plan period.

#### **Subsidy**

**5.4.** Sanction for open borings with strainers is accorded (for the areas fixed) severally or jointly at 50 per cent subsidy basis as is done in the case of wells and open borings without strainers. Subsidy on the cost of diesel pumps is admissible, while in the case of electric motors the cost is to be borne by the beneficiaries themselves. 50 per cent subsidy is also admissible on other water lifting devices such as rahats, Bihar Foot Pumps, and diesel pumping sets etc. Such subsidised open wells etc. visited by the Team are discussed in the following paragraphs:—

**5.5. Seth Phulchand's surface well at Jamshedpur.**—A well with 10 ft. diameter and 25 ft. depth has been constructed for an area of  $1\frac{1}{2}$  acre owned by Seth Phulchand at the outskirts of Jamshedpur. The area is provided with a boundary wall and has a country house constructed in it.

**5.6.** The well was stated to have been constructed with 50 per cent Government subsidy at a cost of Rs. 1,200. Since, under the rules, area on the well is less than the specified, electric pumping set has been installed by the owner at his cost.

**5.7.** Whether or not the financial status of the person requesting for the grant of 50 per cent subsidy for such purposes is required to be taken into account, and how far it is ensured that the construction of the scheme will augment agriculture production, are the issues to be considered. The

grant of subsidy for such a garden owned by a financially well to do person is questionable especially when it is not likely to help in production of any additional food.

**5.8. S.P. Well at S.M. Farm Rajnagar.**—Rajnagar Seed Multiplication Farm in district Singhbhum was established in the year 1959. Total area of the Farm is 26 acres out of which culturable area is 23.5 acres.

**5.9.** A surface percolation well of 36 ft. depth and 10 ft. internal diameter has been constructed for the Farm at a cost of Rs. 3,100. It is fitted with a 5 H.P. diesel pumping set. Water column at the time of the Team's visit towards the end of October 1964 was 30 ft. The pumping set is capable of dewatering the well in about 2½ hours, needing thereafter about 4 hours time to recuperate. It is felt that a pumping set of smaller horse power would be better suited as fast evacuation may endanger the masonry structure of the well.

**5.10.** During *Kharif* 1964 the area under crop in the farm was as under:—

Paddy	15.31 acres.
Maize and Arhar	5.50 acres.
Cotton	0.50 acres.

35 kilograms of cotton was stated to have been picked by the end of October and about the same quantity was further expected.

**5.11.** This one well is apparently inadequate to meet irrigational requirements of the farm. Further arrangements for irrigation need to be investigated.

**5.12. Damodar Valley Corporation Wells.**—The displaced families from the D.V.C. Tilaiya Dam Project area are resettled in two villages namely Bachhai and Singrawa in Gaya district. These villages were visited by the Team. 5 acres of land was given to each family and each holding is provided with an open well with 10 ft. diameter and 30 to 40 ft. depth. Water table of the wells towards the end of October 1964 was about 4 ft. below ground level. Patches of sugarcane could be seen on the wells in the area. Potatoes and other vegetables are also grown there. The strata is such that after 5-6 hours continuous manual drawal, the wells have to be left for the rest of the day to recuperate. Recharge rate is rather slow.

**5.13.** Estimated cost of sinking a well was Rs. 2,000 but actually the cost varied from Rs. 1,600 to Rs. 1,800. Cost was borne half and half by the D.V.C. Rehabilitation Department and the Bihar Government. Rahats or other lifting devices e.g., 'dhekulies' could be fixed with 50 per cent subsidy from the Government. It was stated that the people have not come forward to contribute their share of 50 per cent for the rahats and are urging upon the Government to bear the entire cost. It is strange that just for the provision of a 'latha' for a 'dhekuli' on the wells costing hardly about Rs. 10 some of them are waiting for the State help. Resettlement was done about 10 years back but still monetarily the settlers profess to be poor. An urge towards self help needs to be created in them.

**5.14. Lakra Project.**—About 7 miles from Deoghar, district Santhal Parganas, a surface well of 30 ft. diameter and 60 ft. depth has been constructed by the M. I. Division, Deoghar at a cost of Rs. 35,741. The

well has been constructed in an old tank. Apart from the subsoil supplies, water of the tank when available finds its way into the well through openings provided for the purpose. Area under command of the well is 163 acres. Cost per acre works out to Rs. 218.50.

**5.15.** A rectangular sump tank  $7\frac{1}{2}$  ft. high with sides  $4\frac{1}{2}$  ft. each has been constructed 15 ft. above the ground level. Water for distribution through two  $9 \times 9$  inches lined channels taking off from the bottom of the surge tank is pumped into it from the well with a 5 H.P. diesel pump.

**5.16.** This well was completed in October 1964. It is not known how it is functioning and what discharge it has actually yielded and how much area it is actually irrigating.

**5.17. Ashanagar 4 inch OBS.**—Close to Bihar Sharif in village Ashanagar a 4 inch open boring with strainer was done in the year 1962. Estimated cost of the scheme with boring up to a depth of 350 ft. inclusive of the cost of motor etc. was Rs. 7,080. Actual expenditure with boring up to 181 ft. and excluding the cost of motor, came to Rs. 2,718.

**5.18.** The scheme has been sanctioned to serve an area of 17.65 acres. Shri Kashi Parshad on whose request the scheme was sanctioned is stated to own about  $\frac{1}{3}$ rd area of the command. He supplies water @ 25 paise per Katha\* per watering (which works out to Rs. 8 per acre per watering) to the other owners of the remaining  $\frac{2}{3}$ rd area.

**5.19.** How far such "virtual owners" faithfully discharge the commitments to meet with the demand from the other shareholders, particularly during keen demand period and at specified rates is not known. Some sort of guarantee needs to be obtained from such "owners" of the schemes to safeguard the interests of other shareholders against any possible exploitation. The rate being charged is evidently high.

**5.20. 6 inch Tubewell at Haripur.**—The Team visited a 6 inch tubewell being bored in village Haripur, P.S. E kangarsarai, district Patna towards the middle of October, 1964. Estimated cost of the unit is Rs. 17,000, half of which will be borne by the Government as subsidy, and the other half by the applicant Shri Munishwar Lal who is stated to own about 16 acres area in the command. The applicant has co-opted the adjoining land owners to make up 75 acres command the minimum required for which 6 inch subsidised tubewell on 50 per cent subsidy can be sanctioned.

**5.21.** The boring was in progress when the Team visited. Supervision of the work was being exercised by a Mate of the Minor Irrigation Department. Boring equipment costing about Rs. 35,000 was supplied departmentally on hire @ Rs. 10 per day. Record of the labour employed on the work is also maintained by the Mate. Against the share of 50 per cent cost, an on account payment to the labour was being made by the applicant.

**5.22.** Boring of the tubewell had commenced on the 1st November, 1964 and with about a week's break it had gone 110 ft. deep in over two months when the Team visited. 14 persons were at work @ Rs. 2 per head per day. As per rules, in the case of failures encountered in striking water, the entire cost incurred on the project is borne by the Government.

\*As per Bihar measurement 1 acre=32 Kathas, and 1 bigh=20 Kathas.

5.23. In this case too as in Ashanagar boring mentioned earlier, there does not appear to be any agreement or understanding with the principal owner as to how and on what terms and rates he will supply water to others whose area has been shown on the boring. This needs looking into and wide publicity so that the comparatively poorer land holders are not exploited.

5.24. **Emergency River Pumping Sets.**—The State has also purchased mobile pumping sets to utilise supplies in the rivers and streams by direct pumping. Pumping sets are installed at suitable places on the banks of streams where commands are available and water is supplied for irrigation on the same basis as on State tubewells. Some details with respect to the performance of 119 such pumping sets of 12 to 20 H.P. for the years 1963-64 and 1964-65 supplied by the State authorities are given in *Appendix IX*. Division-wise distribution thereof is reproduced in Table 5.1.

TABLE 5.1

Sl. No.	Name of the Division	No. of E. R. P. Sets	Annual Average			Annual Average per ERP Set		
			Irrigation (acres)	Assessment (Rs.)	Hours run	Irrigation (acres)	Assessment (Rs.)	Hours run
1.	Arrah	19	2,428	22,798	18,326	128	1,200	965
2.	Patna	48	2,110	18,500	6,003	44	385	125
3.	Muzaffarpur	36	1,707	6,593	4,758	47	183	132
4.	Samastipur	6	142	N.A.	761	24	N.A.	127
5.	Darbhanga	10	780	2,892	2,771	78	289	277
Total		119	7,167	50,783	32,619	60	449	274
Average			60	449	274			

Computing on the basis of the performance of 119 E.R.P. sets in 1963-64 and 1964-65 annual irrigation comes to 7,167 acres, and average per E.R.P. set 60 acres only. The average annual running hours per set are only 274. It was stated that these pumping sets are also used for dewatering of flood accumulated waters from low lying area wherever required particularly in North Bihar and their functioning on such jobs is also included in the reported running hours.

5.25. E.R.P. sets mostly being diesel operated, the cost of drawing water is much higher than the expenditure on electric operated tubewells. Cost of operation of 18 B.H.P. diesel operated pumping sets capable to give a discharge of about 1.5 cusecs is roughly as under:—

1. Diesel H.S.D.	5 litres	Rs. 3.75
2. Mobiloil	1 litre	Rs. 2.00
3. Depreciation		Rs. 1.00
4. Work charge and M & R Exp.		Rs. 2.25
		Rs. 9.00

The average running hours per acre of area irrigated works out to 4.5 from Table 5.1. Thus the cost of irrigating one acre (excluding overhead charges) is Rs. 42 against which the realisation charge on an average is Rs. 7.5 per acre. It means a loss of about Rs. 35 per acre of area irrigated by these pumping sets.

5.26. Expenditure figures on the E.R.P. sets have been supplied only for Darbhanga Waterways Division. There are 10 E.R.P. sets in the Division and their financial performance is reported to be as below:—

	1963-64 (Rs.)	1964-65 (Rs.)
M & R and Establishment expenditure . . . . .	22,786	22,002
Assessment of water rates . . . . .	1,908	3,877
Net loss . . . . .	<u>20,878</u>	<u>18,125</u>

The State Government has thus sustained a net average annual loss of Rs. 19,501 on 10 E.R.P. Sets in Darbhanga Waterways Division. The loss amounted to Rs. 1,950 per set annually.

5.27. Looking at the season-wise crop break up of irrigation on the E.R.P. sets detailed in *Appendix IX*, it will be seen that the maximum utilisation on them is during *kharif* with 37 acres annual average per set. This average comes to 7 acres for hotweather, and 17 acres for *rabi*. Such units on river banks function fairly well in *kharif* season when the rivers are full to the banks. In winter and hot weather when the river flows are very much reduced and water usually recedes from the banks, most of the E.R.P. sets remain idle.

5.28. The observations made above go to indicate that the State would continue to suffer losses in the E.R.P. sets year after year. The gain in the crops on account of seasonal use of these pumping sets is also limited. The Team feels that an agriculture plan needs to be worked out so that the E.R.P. sets are put to use for a larger period and thus yield greater advantage than what has been possible so far.

## CHAPTER VI

### PLANNING AND PROSPECTING OF MINOR IRRIGATION WORKS

**6.1.** Bihar is predominantly an agricultural State. The two distinct parts of the State are the alluvial tract in the north and central Bihar and the hilly terrain of the Chhotanagpur region in the south. The need and pattern of irrigation in the two tracts has, of necessity, to be different. While the alluvial tract has got generally rich groundwater supplies, the hilly tract of Chhotanagpur area can be helped only through small surface storages. Nevertheless a unified financial and technical criterion should govern the constructional and operational aspects of small irrigation projects in the State. Some significant features as came under observations of the Team during their study of minor irrigation works in the State are discussed in the paragraphs following.

#### **Irrigation Codes**

**6.2.** Minor Irrigation works in Bihar fall under the purview of three Irrigation Codes *viz.*, the Bengal Irrigation Act of 1876; the Bihar Public Irrigation and Drainage Works Act of 1947; and the Bihar Private Irrigation Works Act of 1922. Within the purview of these Acts works costing individually up to Rs. 15 lakhs, can be reckoned as minor irrigation works. The implications of all the three Acts mentioned above vary considerably.

(a) *Under the Bengal Irrigation Works Act of 1876*, entire cost of the Project is borne by the Government and areas benefited are assessed to water rates. Works built under this category are mostly managed by the Waterways Department.

(b) *The Bihar Private Irrigation Works Act of 1922.*—It originally provided for recovery of the entire cost of repairs etc. to an existing irrigation work, or of construction of new works from the beneficiaries. Relevant Sections 11 and 35A of the Act (V of 1922) have been amended *vide* the Bihar Private Irrigation Works (Amendment) Act, 1959. Under the Grow More Food programme at present only 50 per cent of the cost of works is realised and the remaining 50 per cent is borne by the State Government. In certain circumstances, if necessary, even the whole or a part of the amount payable by the beneficiaries is remitted. No assessment of water rates is done on such works. The work after completion is handed over to beneficiaries for maintenance and operation.

(c) *The Bihar Public Irrigation and Drainage Works Act of 1947.*—Section 12 lays down that the cost initially is to be borne by the Government, which under Section 23 of the said Act is to be recovered from the beneficiaries with interest at the rate of 5% in maximum 10 instalments. The maintenance of works also rests with the State Government for a specified period and maintenance charges are recovered from the beneficiaries under Section 24. No levy of water rate is done.

**6.3.** With such varying provisions under different Acts there naturally exists a disjointed state of development with regard to small irrigation works. This becomes clear from the observations made by the Team in the foregoing Chapters.

6.4. It will be advantageous if a unified approach in this direction is evolved so that financial, organisational and maintenance standards are effectively applied to small irrigation works in the State.\*

### Fard-Abpasi Rights

6.5. With the abolition of *Zamindari* system the State Government inherited the responsibility and obligations of *Zamindars*. In the wake of grow more food activity renovation and stream-lining of a large number of existing works of the types of Ahars and Pynes was taken in hand. The improvised kacha obstructions which used to be put in the natural drainages and rivulets for diverting water for irrigation purposes were replaced by masonry structures. Embankments were strengthened and outlets were provided wherever necessary. This helped stabilising irrigation supplies and extending the irrigated areas in some cases.

6.6. While these works were under the control of *Zamindars*, the cultivators, used to render voluntary labour assistance and were entitled to free use of water in lieu thereof. No water rates were then levied, under Fard-Abpasi rights. In view of the huge expenditure now being incurred on such works it will seem necessary to review the policy of free supply of water and extinguish Fard-abpasi rights.

6.7. If actual irrigation done is recorded season after season, it will also be possible to judge how much extra area is being benefited besides stabilisation of irrigation through a programme of reconstruction and renovation taken up by the Government.

6.8. Sample surveys for this purpose need to be organised in the various representative zones of the State. The results would be helpful in giving guidelines for future planning and prospecting of such programmes, and in improvement of their existing utilisation.

### Arrears in respect of recoveries

6.9. The statement given in Table 6.1 shows amounts in arrears in respect of works executed under the Bihar Private Irrigation Works Act of 1922:—

TABLE 6.1

	Total amount recoverable Rs.	Amount recovered Rs.	Balance to be recovered as on 1-4-64 Rs.
Minor Irrigation Department	... 12,09,963	379 (Bhagalpur)	12,09,584
Agriculture Department	... 1,16,83,318	1,22,795	1,15,60,523
<b>TOTAL</b>	... 1,28,93,281	1,23,174	1,27,70,107

It will be seen that Rs. 1,28,93,281 were recoverable out of which only Rs. 1,23,174 has been recovered up-till 1st April, 1964. This works out to 0.95 per cent of the amount recoverable.

\*The State authorities also agree to evolve a unified approach to do away with varying provisions. They are of the opinion that Schemes costing above Rs. 2,500 be executed under the Bengal Irrigation Act.



6.10. The increase in crop production that accrues to the cultivators through irrigated agriculture is quite substantial. It should not be difficult for the beneficiaries to pay back the cost due from them, which were spread over a number of years in easy instalments. The Team, therefore, feels that some machinery should be evolved for strict enforcement of the provisions of Bihar Private Irrigation Works Act of 1922 and Bihar Public Irrigation and Drainage Works Act, of 1947 to effect realisation of arrears as 'public demand.' If arrears continue like this, it will eventually have an adverse effect on development of irrigation in the State. The problem therefore, warrants urgent attention of the State authorities.\*

#### **Appraisal of Surface and Subsoil Resources**

6.11. Surface and subsoil water resources put under agricultural use in the State need to be comprehensively ascertained so that planning of irrigation works whether small or big could be done on a systematic basis. Planning Commission has already drawn attention of the various States to this important aspect of water resources ascertainment in a circular letter No. 3-2(7)61-Agri. dated 21-10-57 addressed to the Development Commissioners of the States, reproduced in *Appendix X*.

#### **Water Courses**

6.12. Provision of well-aligned water courses in the command of irrigation schemes is essential to attain a sound and economical management of irrigation supplies. It is, in fact, an integral part of planning of irrigation schemes. During their studies, the Team had observed that this essential aspect of irrigation planning has not received due attention, more particularly on minor irrigation works.

6.13. Bihar Private Irrigation Works Act of 1922 and Bihar Public Irrigation and Drainage Works Act of 1947 are both silent on this fundamental aspect. The Team, therefore recommends enactment and incorporation of suitable provisions as provided in Sections 47 to 73 Part V of Bengal Irrigation Act of 1876, so that this important aspect of irrigation development does not remain unattended in respect of small irrigation schemes.

#### **Double-Cropping**

6.14. The team feels that double cropping, more particularly in areas where irrigation facilities are possible either from surface or groundwater resources should be planned and pushed through. As at present, on vast areas double-cropping is insignificant even in areas where State Tubewells have been built.

6.15. Close co-ordination of Agriculture and Irrigation wings of the State administration need to be developed, so that wherever irrigation facilities exist they are made use of to the fullest possible extent. In this direction it will seem advantageous if Irrigation and Agriculture officials are made conversant with the elements of agriculture and irrigation norms through an integrated course designed for the purpose. Progressive farmers of the State could also be introduced to this course, so that efforts of the State authorities are received and reciprocated by them with understanding and co-operation. That will eventually help in better planning and prospecting of irrigation works in the State.

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\*The State authorities have stated that the issue is already receiving due attention in the State.

## SUMMARY OF RECOMMENDATIONS

Bihar, generally, has ample rainfall. It is, however, not well distributed over time. Need for artificial irrigation is often felt, when there is a long break in monsoon or when a continued drought occurs, as also for winter and hotweather cropping. Irrigation has, therefore, a significant place in the agricultural economy of the State. Techno-economic appraisal of its minor irrigation works, as presented in this report, may thus invoke interest towards their better performance. Apart from points of routine nature contained in foregoing chapters, the Team's recommendations on matters of special significance, are as summarised below:—

I. Outletting on irrigation channels needs to be done on a scientific basis, keeping in view the ground levels and of commanded areas to be served by each outlet.

(Paras 2.9, 2.15, 3.8, 3.10 & 3.21).

II. Watercourses need to be properly aligned. For their construction and maintenance, statutory provisions under the Bihar Private Irrigation Works Act, 1922 and the Bihar Public Irrigation and Drainage Works Act, 1947 are also needed mostly according to what exists in Sections 47 to 73, Part V of the Bengal Irrigation Act of 1876.

(Paras 2.11 & 6.13).

III. A Unified Irrigation Code in place of the three Acts, at present under operation, may enable more effective control being exercised over small irrigation works, which are dispersed all over the State.

(Paras 2.70, 6.2 to 6.4).

IV. To assess the benefits of irrigation, crop cutting experiments both in irrigated and adjoining unirrigated areas, needs to be carried out.

(Para 2.24).

V. Ascertainment of irrigation benefits also needs to be done where Irrigation-cum-water supply schemes exist.

(Para 2.28).

VI. Apart from the diversion bunds and weirs, offtaking channels also need to be remodelled, whenever, minor irrigation schemes are taken up for renovation or remodelling.

(Paras 2.41 & 2.43).

VII. Actual field irrigation needs to be recorded on all types of works to enable a watch being kept on actual field efficiency of irrigation schemes. The result would be helpful in providing guideline for future planning and prospecting of irrigation works.

(Paras 2.42 & 2.68).

VIII. Irrigation works transferred to the charge of Panchayats, need to be subjected to periodical technical inspections to ensure their proper upkeep.

(Paras 2.47, 2.53, 2.69, 3.19, 3.23, 3.26, 3.27, 3.31 & 3.39).

IX. Overlapping of irrigation facilities in such commands, which are already catered for from other schemes, need to be avoided.

(Para 3.36).

X. In view of under utilisation of irrigation potential concerted efforts need to be mobilised to maximise the utilisation of irrigation supplies available at least from State tubewells, more particularly in North Bihar.

(Paras 4.6 & 4.13).

XI. With plenty of "ready-at-hand" tubewell supplies, development of intensive agriculture in their commands on scientific basis seems urgently called for.

(Paras 4.15 & 4.29).

XII. Approach roads to tubewell sites may be provided, wherever possible.

(Para 4.24).

XIII. Maintenance charges on State tubewells need to be reviewed more particularly when they are running at an average loss of over Rs. 6,000 per tubewell per year.

(Paras 4.27 & 4.28).

XIV. Supply of water from State tubewells on volumetric basis, may lead to economic use of water and improve the operational and financial performance of tubewells. The Uttar Pradesh system could be adopted in this respect.

(Para 4.30).

XV. Measures need to be taken to enable water to be supplied at reasonable rates to collaborating cultivators from subsidised schemes of private tubewells and Open Boring with or without strainers.

(Paras 5.18, 5.19 & 5.23).

XVI. Emergency River Pumping units need to be subjected to year-round-use as far as possible.

(Para 5.28).

XVII. 'Fard-ab-pashi' rights for the cultivators requiring free supply of irrigation water in lieu of the voluntary labour supplied by the beneficiaries for the maintenance of irrigation works needs to be extinguished where the practice has ceased to operate with the abolition of zamindari.

(Paras 3.11, 6.5 & 6.6).

XVIII. Recoveries of huge outstanding from beneficiaries as have accumulated, need to be effected.

(Paras 6.9 & 6.10).

XIX. Comprehensive survey of surface and subsoil resources of water need to be made to enable systematic planning of irrigation works, both big and small.

(Para 6.11).

XX. Double cropping on irrigation schemes more particularly on State tubewells, should be planned and practised.

(Para 6.14).

XXI. Agriculture and Irrigation personnel need to be made conversant with field technicalities of agriculture and irrigation practices through an integrated course designed for the purpose. Progressive farmers of the State could also be introduced to the proposed course.

(Para 6.15).

## APPENDICES

- I. Terms of Reference.
- II. Record note of the meeting held at Patna on the 26th August, 1964.
- III. District-wise normal monthly rainfall. **Para 1.9**
- IV. Operational and financial performance of the Plan period M.I. Works constructed under the Bengal Irrigation Act, 1876. **Para 2.65**
- V. Schedule of water rates levied on State tubewells and E.R.P. sets. **Para 4.10**
- VI. Group-wise performance of tubewells in north-eastern districts of Uttar Pradesh. **Para 4.17**
- VII. Crop-wise area irrigated per tubewell on different groups in Gorakhpur district of Uttar Pradesh. **Para 4.17**
- VIII. Scheme-wise capital cost of 974 State tubewells in Bihar. **Para 4.26**
- IX. Operational and financial performance of Emergency River Pumping sets. **Paras 5.24 & 5.27**
- X. Copy of letter No. 3-2(7)/61-Agri., dated the 21st October, 1961 from the Planning Commission, Government of India, New Delhi, to the Development Commissioners/Planning Secretaries, all States.

## APPENDIX I

### *Terms of Reference*

The minor irrigation projects may be divided for study into two parts:—

- (a) Works already in existence.
- (b) Works which are now being constructed.

2. Case studies should be made of a number of projects of each type under the above headings with a view of judging their efficiency having regard to the objectives with which such works were carried out.

3. The following points should be especially borne in mind:—

#### **Existing Projects**

- (i) The present state of repair and maintenance.
- (ii) The system of keeping works in proper maintenance with particular reference to the customary obligations of villagers for keeping such works in a sound condition from year to year, the team should also examine the extent to which these obligations are enforced, the reasons for the failure to do so and the steps that should be taken to carry out such obligations efficiently.
- (iii) Reasons, if any, for non-utilisation of water by cultivators.
- (iv) Improvements necessary to make the projects more efficient either in the matter of better agricultural planning and practices or in respect of engineering works.
- (v) Cost of restoration if the project is in a state of disrepair and whether it has been included in the Plan.

#### **New Projects**

- (i) Method of selection—procedure and principles on which priorities are based.
- (ii) Flow Chart of the construction Project should be prepared to examine whether any avoidable delay has occurred in its completion.
- (iii) Whether fullest use is made of catchment capacity in preparing design.
- (iv) Economics of design.
- (v) State of agricultural planning with a view to optimum utilisation of benefits.
- (vi) Institutional arrangements provided for the proper maintenance of new works with special reference to the customary obligation of villagers in this regard.
- (vii) Cost of actual construction compared to estimated costs—the reasons for increase if any and the care with which the initial estimates were framed.

4. Any other matter which the Team considers necessary to report upon having a bearing on economy and efficiency of such projects.

5. The following information should be gathered by the Team for each State, taken as a whole in regard to existing minor irrigation works:—

- (i) The Total area irrigated from them according to Settlement registers.
- (ii) The area actually irrigated from year to year beginning from 1947.
- (iii) The reason for the reduction, if any, in the area irrigated.

6. In addition, the Team will carry out a study of the tubewell schemes of the Punjab and the U.P. with reference to the fact whether optimum use has been made of the facilities available by ensuring scientific crop planning and by improving agricultural practices. The study should be based on an examination of individual tubewells, which may be divided into most successful, successful and least successful varieties for the purpose of study. The Team should also select a few tubewells for which alternative crop planning and practices may be recommended that are being carried out at present in order to make them more successful. The consideration mentioned regarding minor irrigation works in paragraph 3 *mutatis mutandis* be taken into consideration for the study of tubewells also.

## APPENDIX II

*Record Note of the Meeting held at Patna on the 26th August, 1964*

The following were present:—

### **Bihar State**

1. Shri M. P. Sinha,  
Irrigation Minister.
2. Shri A. P. Prashad,  
Chief Engineer,  
Irrigation & Waterways.
3. Shri S. N. Ray,  
Chief Engineer,  
Minor Irrigation.
4. Shri B. P. Akhaury,  
Director of Agriculture.

### **Committee on Plan Projects**

1. Shri Baleshwar Nath,  
Member, Irrigation Team.
2. Dr. Arjan Singh,  
Member, Irrigation Team

### **In attendance**

1. Shri J. R. Kumar,  
Research Officer,  
Irrigation Team.
2. Shri Nokhey Lal,  
Economic Investigator,  
Irrigation Team.

Shri Baleshwar Nath, Member Irrigation Team presented compliments on behalf of the Leader of the Team, Shri M. Thirumala Rao, who being out of India could not participate in the deliberations. He explained the objectives of the study of minor irrigation works which the Team was going to take up in Bihar.

Shri Ray, Chief Engineer, Minor Irrigation, gave a general appraisal of the execution and functioning of minor irrigation works in the State. Since there was no booking of irrigation and no levy of water rates on large number of works falling under the purview of the Bihar Private Irrigation Works Act, 1922, their serviceability could not be correctly estimated, he added. He further said that the small irrigation works which used to be maintained by the erstwhile Zamindars through voluntary labour have not received due attention after the abolition of Zamindari system, and quite a number of them have gone in a state of disrepair.

Dr. Arjan Singh enquired about the cropping pattern and yield of crops. The Director of Agriculture said that with the provision of irrigation supplies serious efforts are being made to educate the cultivators to take to irrigated crop pattern. Irrigated sugarcane particularly in South Bihar gives an extra yield of about 400 mds per acre a premium of about Rs. 800 over the unirrigated crop, he added. Dr. Singh further enquired about the functioning of agricultural farms, and was told that such farms in the State numbered about 500, and roughly 2/3rd of them were giving some profits.

Shri A. P. Prashad, Chief Engineer, indicated that the tail race supplies of the Rihand Project were being actively put to use in irrigating Kharif crops.

Shri Baleshwar Nath enquired about the efficiency of the State tubewells. Shri Prashad indicated the tubewell zones on the State's Master Plan. He said that in view of the distinctly varied pattern of agriculture as well as climatic and topographical conditions of North Bihar, development of tubewells in the northern region has been slow.

The Minister was particularly concerned about the poor performance of tubewells and deteriorating condition of a large number of ahars and other small irrigation works going out of use consequent on the abolition of Zamindari in the State. He showed considerable interest in the purpose of the study, the Team was undertaking, and assured the Members about the fullest possible co-operation of the State authorities in pursuing the studies.

Shri Baleshwar Nath said that the problems emerging out of the abolition of Zamindari were also faced in other States like Maharashtra, where in Vidharba region, a large number of ex-Malguzari tanks have deteriorated in recent years. Their renovation was being taken up there on a phased programme on priority basis under a special estimate.

APPENDIX III

Statement showing Monthly normal rainfall in each District of BIHAR State (in inches)

DISTRICT	January	February	March	April	May	June	July	August	September	October	November	December
1	2	3	4	5	6	7	8	9	10	11	12	13
Patna ...	0.51	0.73	0.31	0.28	0.99	4.98	10.61	11.24	7.47	1.77	0.40	0.17
Gaya ...	0.74	0.96	0.47	0.26	0.87	5.46	12.48	13.50	7.58	1.94	0.50	0.20
Shahabad ...	0.64	0.90	0.37	0.22	0.67	5.19	12.59	13.03	7.87	2.04	0.39	0.28
Saran ..	0.48	0.68	0.29	0.28	1.39	6.50	12.41	11.78	8.59	2.10	0.26	0.15
Champanan ...	0.47	0.70	0.49	0.68	2.47	9.17	15.66	13.30	10.41	2.37	0.28	0.18
Muzaffarpur...	0.41	0.64	0.42	0.49	2.04	7.27	12.21	11.71	8.75	2.06	0.29	0.15
Darbhanga ...	0.36	0.60	0.43	0.73	2.77	7.82	12.65	12.01	9.41	2.46	0.29	0.13
Monghyr ...	0.61	0.82	0.49	0.54	2.01	7.16	12.11	12.24	9.00	2.67	0.36	0.14
Bhagalpur ...	0.58	0.81	0.53	0.62	2.36	6.99	11.76	10.80	8.09	2.94	0.39	0.11
Saharsa ...	0.41	0.52	0.47	1.05	3.97	9.25	10.39	11.86	9.99	2.67	0.36	0.11
Purnea ...	0.34	0.66	0.51	1.16	4.71	11.12	15.34	13.36	11.53	3.48	0.31	0.11
Santhal Parganas	0.55	0.88	0.67	0.81	3.25	9.05	12.77	12.16	9.74	3.72	0.47	0.13
Hazaribagh ...	0.83	1.21	0.69	0.43	1.51	6.94	13.05	13.01	8.25	2.89	0.52	0.22
Ranchi ...	0.91	1.71	0.98	0.73	1.79	7.98	15.68	14.99	8.52	3.38	0.68	0.26
Palamau ...	0.96	1.35	0.68	0.39	0.79	6.55	14.69	15.10	7.87	2.26	0.70	0.28
Manbhum ...	0.59	1.36	0.91	0.69	2.48	8.25	13.04	12.84	8.02	3.43	0.40	0.19
Singhbhum ...	0.63	1.51	0.93	0.96	2.84	8.69	13.38	13.84	7.97	2.95	0.54	0.19
Bihar ...	0.51	0.76	0.45	0.55	2.11	7.27	12.70	12.27	8.91	2.48	0.36	0.16
Chhota Nagpur	0.80	1.42	0.83	0.61	1.78	7.59	14.34	14.04	8.12	2.96	0.58	0.23

Source: Director General of Observatories, Poona (Reproduced from Bihar Statistical Hand Book 1960, Page 25).

APPENDIX IV

*Operational and Financial performance of the Plan Period Minor Irrigation Works constructed under the Bengal Irrigation Act, 1876. (Bihar State).*

Sl. No.	Name of the Scheme	Waterways Division	Year of completion	(Area in acres) (Assessment and expenditure in Rs.)														
				Capital Cost (lac Rs.)	Annual Irrigable area	Actual area irrigated 1962-63	Actual area irrigated 1963-64	Actual area irrigated 1964-65	3 years average	Amount Assessed 1962-63	Amount Assessed 1963-64	Amount Assessed 1964-65	3 years average	M & R expenditure 1962-63	M & R expenditure 1963-64	M & R expenditure 1964-65	3 years average	Percentage of utilization col. 10
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1.	Lotia	Ranchi	1962	2.45	1600	17	400	330	249	170	4000	3300	2490	12548	2995	6000	7181	16
2.	Kutipisi	Ranchi	1962	3.11	1350	..	320	310	315	..	3200	3100	3150	17690	3000	6000	8227	23
3.	Rajbandh	Singhbhum	1959	1.87	1200	200	330	200	243	2000	3300	2000	8430	593	863	1000	819	20
4.	Bucha-opa	Ranchi	1957	7.21	1900	1560	526	585	890	14288	5308	5890	8495	4100	5025	4000	4375	47
5.	Nandini	Ranchi	1960	8.62	3000	2800	250	2430	1827	28000	25000	24300	18270	6451	5018	3000	4823	60
6.	Tati	Biharsharif	1963	4.08	4000	630	1000	4000	1877	6300	10000	40000	18770	4505	6461	3000	4655	47
7.	Bajan I. Scheme	Jamui	1963	6.40	2400	..	430	1290	860	..	4300	12900	8600	..	15000	10000	12500	36
8.	Bagra I. Scheme	Bhagalpur	1963	2.40	1000	980	600	450	677	9800	6000	4500	6770	4633	4253	5000	4629	68
9.	Phirangi Bigha	Biharsharif	1964	4.38	3400	..	2000	3400	1800	..	20000	34000	18000	6569	9058	4000	6539	53
10.	Adra	Palamau	1959	2.95	1300	750	850	1200	933	7500	8500	12000	9333	..	..	..	..	72
11.	Trisula	Jhanjharpur	1961	4.61	3600	900	1500	1030	1143	9000	15000	10300	11430	N.A.	N.A.	N.A.	..	32
Total Sl.No. 1 to 9				40.52									86975				50254	



APPENDIX IV—Contd.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
12.	Batre	Aurangabad	1957	6.62	5740	6200	4000	6100	5433	62000	40000	61000	54330	N.A.	N.A.	N.A.	..	94
13.	Mohania	Tarapur	1964	8.50	4800	—	..	1100	1100	—	—	11000	11000	N.A.	N.A.	N.A.	..	23
14.	Ajan River	Jamui	1956	5.08	3600	3700	3650	3600	3650	37800	36900	36000	36900	N.A.	N.A.	N.A.	..	101
15.	Ganaili	Bhagalpur	1957	0.98	1200	1000	1200	1000	1067	10000	12000	10000	10670	N.A.	N.A.	N.A.	..	89
16.	Kundghat	Jamui	1957	4.80	4000	4040	4000	4100	4047	40400	40000	41000	40470	N.A.	N.A.	N.A.	..	100
TOTAL.				74.06	44090	22757	29856	31125	27913	284798	248328	305090	279405	57089	51673	42000	50254	64

APPENDIX V  
GOVERNMENT OF BIHAR  
IRRIGATION DEPARTMENT  
NOTIFICATION

*Dated, Patna 31-5-63*

No. C/R8-2012/63-I 12462.—In supersession of all previous rates announced by the State Government for supply of water from tubewells and E.R.P. sets it is notified for general information that the Governor of Bihar is pleased to fix the rate specified below, with effect from the ensuing *Kharif* season which commences from the 25th June, 1963.

Class of lease	Period	Nature of crops	No. of Waterings	Rates	
				North Bihar	South Bihar
1	2	3	4	5	6
<b>KHARIF</b>					
(1) <i>Kharif</i> Season lease.	25th June to 25th October.	Paddy.	3 waterings without limitation of volumetric basis of supply of water.	Rs. 7	Rs. 9
(2) Other than <i>Kharif</i> Season lease (Single watering).	Do.	Paddy and other food crops like Marua, Kodon, etc.	Single watering without limitation of volumetric basis of supply of water.	Rs. 4	Rs. 4.75
<b>RABI</b>					
(3) <i>Rabi</i> season lease.	26th Oct. to 25th March.	Wheat, Barley, Gram, Peas other food crops.	Two waterings without limitation of volumetric basis of supply of water.	Rs. 5	Rs. 6
(4) Other than <i>Rabi</i> season lease (Single watering).	Do.	(a) Wheat Barley, Gram, Peas and other food crops.	Single watering without limitation of volumetric basis of supply of water.	Rs. 3.50	Rs. 4
		(b) Chillies and Tobacco.	Single watering without limitation of volumetric basis of supply of water.	Rs. 6	Rs. 7

APPENDIX V—Contd.

1	2	3	4	5	6
(5) <i>Rabi</i> Season lease.	26th Oct. to 25th March.	(a) Early potato.	4 waterings without limitation of volumetric basis of supply of water.	Rs. 19	Rs. 20
		(b) Double potato.	9 waterings without limitation of volumetric basis of supply of water.	Rs. 34	Rs. 34
		(c) Late Potato.	6 waterings without limitation of volumetric basis of supply of water.	Rs. 23	Rs. 23
<b>HÓT WEATHER</b>					
(6) Hot weather season lease.	25th March to 24th June.	(a) Crops other than sugarcane.	2 waterings without limitation of volumetric basis of supply of water.	Rs. 6	Rs. 7
		(b) Sugarcane.	3 waterings without limitation of volumetric basis of supply of water.	Rs. 17	Rs. 19
(7) Other than Hot weather season lease (Single-watering).	26th March to 24th June.	(a) Crops other than sugarcane.	Single watering without limitation of volumetric basis of supply of water.	Rs. 4.25	Rs. 5
		(b) Sugar cane	Single watering without limitation of volumetric basis of supply of water.	Rs. 7	Rs. 8

By order of the Governor of Bihar

Sd/-  
Deputy Secretary to Government

## APPENDIX VI

### IRRIGATION WORKS CIRCLE GORAKHPUR

*Statement showing performance of Tubewells Group-wise in the Divisions of this Circle*

Sl. No.	Name of Group	Year	No. of T.W. in the Group.	Average discharge per well (G. P. H.)	Maximum			Maximum		
					Average Annual running hours per well			Average irrigation per well		
					Kharif	Rabi	Total	Kharif	Rabi	Total
1	2	3	4	5	6	7	8	9	10	11
<b>TUBEWELL DIVISION GORAKHPUR</b>										
1.	Sardarnagar	1963—64	31	29,260	<u>1573</u> 1057	<u>1284</u> 1284	<u>2857</u> 2341	<u>128</u> 83	<u>224</u> 215	<u>352</u> 298
2.	Gorakhpur	"	86	21,140	<u>1005</u> 500	<u>1039</u> 1039	<u>2044</u> 1539	<u>99</u> 51	<u>219</u> 212	<u>318</u> 263
3.	Bansgaon	"	78	28,390	<u>495</u> 258	<u>667</u> 595	<u>1162</u> 853	<u>65</u> 21	<u>194</u> 170	<u>259</u> 191
4.	Pharenda	"	11	22,890	<u>974</u> 480	<u>879</u> 879	<u>1853</u> 1359	<u>70</u> 35	<u>159</u> 143	<u>129</u> 178
5.	Mahrajganj	"	3	30,210	<u>1144</u> 874	<u>1131</u> 1131	<u>2275</u> 2005	<u>134</u> 90	<u>234</u> 195	<u>368</u> 285
6.	Nichlaur	"	9	32,100	<u>153</u> 153	<u>550</u> 499	<u>703</u> 652	<u>20</u> 20	<u>134</u> 134	<u>154</u> 154
<b>TUBEWELL DIVISION BASTI</b>										
1.	Basti	1963—64	108	30,000	<u>1080</u> 599	<u>739</u> 739	<u>1819</u> 1338	<u>110</u> 59	<u>178</u> 178	<u>288</u> 237

2.	Haiya	„	33	32,000	<u>863</u> 417	<u>515</u> 515	<u>1378</u> 932	<u>80</u> 44	<u>127</u> 127	<u>207</u> 171
3.	I.D. & C.P. Block	„	13	32,000	<u>746</u> 267	<u>259</u> 259	<u>1005</u> 526	<u>61</u> 29	<u>98</u> 98	<u>159</u> 127
4.	Domariaganj	„	36	31,000	<u>982</u> 400	<u>580</u> 580	<u>1562</u> 980	<u>105</u> 31	<u>132</u> 127	<u>237</u> 158
5.	Bansi	„	23	21,000	<u>840</u> 325	<u>524</u> 524	<u>1364</u> 849	<u>88</u> 27	<u>110</u> 110	<u>198</u> 223
6.	Khalilabad	„	80	29,000	<u>869</u> 516	<u>677</u> 677	<u>1546</u> 1193	<u>102</u> 47	<u>176</u> 176	<u>278</u> 223

## IRRIGATION DIVISION DEORIA

1.	Gauri Bazar	1963—64	28	28,734	<u>1504</u> 1166	<u>1125</u> 1125	<u>2629</u> 2291	<u>146</u> 99	<u>190</u> 190	<u>336</u> 289
2.	Deoria	„	98	31,243	<u>1076</u> 875	<u>786</u> 786	<u>1862</u> 1661	<u>133</u> 97	<u>177</u> 177	<u>310</u> 274
3.	Salempur	„	98	34,037	<u>775</u> 387	<u>578</u> 578	<u>1353</u> 965	<u>82</u> 46	<u>169</u> 166	<u>251</u> 212
4.	Padrauna	„	47	32,902	<u>1109</u> 690	<u>719</u> 713	<u>1828</u> 1403	<u>130</u> 74	<u>176</u> 176	<u>306</u> 250
5.	Hata	„	21	32,654	<u>1384</u> 1058	<u>887</u> 887	<u>2271</u> 1945	<u>180</u> 114	<u>179</u> 179	<u>359</u> 293

(including 1 No.)  
T.W. for R.W.S.

APPENDIX VII

TUBEWELL DIVISION GORAKHPUR

Group-wise Statement showing performance of Tubewells in District Gorakhpur

(Area in Acres)

Sl. No.	Name of Group	Year	No. of Tubewells in the group	Average discharge per well (G.P.H.) Kharif/Rabi	Average annual running hours per well			Average Irrigation per well					Total	
					Kh.	Rabi	Total	Kharif			Rabi			
								S.C.	Paddy	O.K.	Wheat	S.C.		Other
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	Gorakhpur	1961—62	75	32904	889	527	1386	63	13	4	90	11	67	248
				32957										
2.	Sardarnagar	„	29	29223	1319	547	1866	76	32	2	58	14	63	225
				31995										
3.	Pharenda	„	12	23533	974	423	1397	66	4	—	78	7	17	172
				24422										
4.	Maharajganj	„	3	35852	1144	380	1524	109	7	—	67	18	50	251
				36475										
5.	Bansgaon	„	74	31189	495	399	889	26	10	2	74	3	59	174
				30576										
6.	Nichlaul	„	9	Not available	—	273	273	—	—	—	75	—	23	98
				32489										
1.	Gorakhpur	1962—63	83	31441	638	814	1452	39	9	1	102	28	87	266
				32781										

2.	Sardarnagar	„	29	<u>28071</u>	1223	1142	2365	54	21	2	90	41	93	301
				31464										
3.	Pharenda	„	12	<u>23773</u>	695	712	1407	42	—	—	82	24	53	207
				29035										
4.	Mahrajganj	„	3	<u>33807</u>	1026	1001	2027	89	5	1	90	64	70	319
				30653										
5.	Bansgaon	„	75	<u>29330</u>	410	668	1078	19	10	1	113	9	72	224
				25974										
6.	Nichlaul	„	9	<u>32488</u>	114	549	663	17	—	1	78	19	35	150
				32488										
1.	Gorakhpur	1963-64	85	<u>31157</u>	518	1039	1454	39	12	2	128	39	48	268
				32771										
2.	Sardarnagar	„	31	<u>28121</u>	1092	1284	2376	54	29	2	100	52	63	300
				31280										
3.	Pharenda	„	11	<u>24043</u>	528	879	1407	37	1	1	67	47	29	182
				29440										
4.	Mahrajganj	„	3	<u>30066</u>	873	1131	2004	76	13	1	103	68	24	285
				27927										
5.	Bansgaon	„	78	<u>28619</u>	269	595	864	15	4	3	80	10	80	202
				29138										

APPENDIX VII—*contd.*

1	2	3	4	5	6	7	8							
6.	Nichlaul	1963-64	9	30597	153	499	650	18	1	1	86	35	12	153
				<u>33606</u>										
1.	Gorakhpur	1964-65	85	31197	880	1273	2153	56	11	3	120	40	94	324
				<u>31366</u>										
2.	Sardarnagar	„	31	26897	1320	1495	2815	71	22	2	121	44	85	345
				<u>29772</u>										
3.	Pharenda	„	14	27973	716	925	1641	45	1	1	93	31	42	213
				<u>29863</u>										
4.	Mahrajganj	„	3	30066	1105	1173	2278	91	5	1	87	52	44	280
				<u>29600</u>										
5.	Bansgaon	„	81	28700	340	858	1198	15	5	2	119	12	95	248
				<u>28394</u>										
6.	Nichlaul	„	9	31315	326	604	930	36	2	2	98	28	23	189
				<u>33606</u>										

*Note.*—S. C.=Sugar cane. O. K.=Other Kharif.



## APPENDIX VIII

*99 Capital outlay on State tubewells.*

		Rs.		Rs.
300 T.W. in N. Bihar . . . . .	1,46,41,457	+40,000	=	1,46,81,457.00
350 T.C.A. . . . .	1,74,62,799	+60,000	=	1,75,22,799.00
35 T.C.M. . . . .	17,08,281	+10,000	=	17,18,281.00
15 T.W. . . . .	16,00,071	+50,000	=	16,50,071.00
Expl. T.W. . . . .	44,936		=	44,936.00
3 Shallow T.W. . . . .	51,982		=	51,982.00
1.T.W., . . . . .	24,462	+ 6,000	=	30,462.00
Art. T.Ws. . . . .	1,557		=	1,557.00
Replacement of failed . . . . .	1,59,009	+1,00,000	=	2,59,009.00
Manjaur & Bagain . . . . .	44,483	+ 18,000	=	62,483.00
Lining & extension of village channel. . . . .	52,55,172	+3,80,000	=	56,35,172.00
New T.W. III . . . . .	1,73,500	+1,25,000	=	2,98,500.00
St. I, II, III. . . . .	23,39,951		=	23,39,951.00
Lining of . . . . .	14,48,669		=	14,48,669.00
Phase I . . . . .	9,70,155		=	9,70,155.00
„ II . . . . .	13,07,053		=	13,07,053.00
Sch. 82 . . . . .	22,199		=	22,199.00
Total 970 T.Wells.		Total	=	4,80,44,736.00
		The cost per T.W.	=	<u>4,80,44,736</u>
				970
			=	49,531 per T.Well

## APPENDIX IX

### *Operational and Financial Performance of Emergency River Pumping Sets*

(Area in acres, Amount Assessed and expenditure in Rupees)

S. No.	Name of the Division	No. of E.R.P.	Targeted Area 1963-64				Irrigated Area 1963-64				1964-65			
			Kharif	Rabi	H.W.	Total	Kharif	Rabi	H.W.	Total	Kharif	Rabi	H.W.	Total
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.	Lift Irrigation Division Arrah.	19	150	250	100	500	1672	585	96	2353	1510	821	172	2503
2.	Lift Irrigation Division Patna.	48	75	100	100	275	1816	176	68	2060	1750	321	90	2161
3.	Waterways and Tubewell Division Muzaffarpur.	36	N.A.	N.A.	N.A.	N.A.	923	604	390	1917	583	451	463	1497
4.	Waterways Division Samastipur.	6	100	150	100	350	29	120	5	154	..	130	..	130
5.	Waterways Division Darbhanga.	10	No target has been fixed.				149	213	173	535	331	520	172	1023
<b>TOTAL</b>		119					4589	1698	732	7019	4174	2243	897	7314
<b>AVERAGE</b>							38	13	6	57	35	19	8	62

APPENDIX IX—*contd.*

*Operational and Financial Performance of Emergency River Pumping Sets*

(Area in acres, Amounts Assessed and expenditure in Rupees)

S. No.	Name of the Division	Amount Assessed								Running Hours								Expenditure	
		1963-64				1964-65				1963-64				1964-65				1963-64	1964-65
		Kharif	Rabi	H.W.	Total	Kharif	Rabi	H.W.	Total	Kharif	Rabi	H.W.	Total	Kharif	Rabi	H.W.	Total	1963-64	1964-65
16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33		
1	Lift Irrigation Div., Arrah.	15295	4897	1598	21790	13581	6944	3270	23805	9939	6330	1000	17269	8753	7524	3106	19383	N.A.	N.A.
2	Lift Irrigation Div., Patna.	16069	1175	799	18043	15402	2215	1139	18956	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
3	Waterways and Tube-well Div., Muzaffarpur.	2366	1326	6089	9781	1666	348	1391	3405	3601	2473	1712	7786	2308	2070	1730	6108	N.A.	N.A.
4	Waterways Div., Samastipur.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	181	677	35	910	..	612	..	612	N.A.	N.A.
5	Waterways Division Darbhanga.	598	747	562	1907	1325	1820	732	3877	523	675	810	2008	1055	1593	885	3533	22786	22002
	TOTAL	34328	8145	9048	51521	31974	11327	6532	49833	14244	10155	3557	27956	12116	11799	5721	29636	22786	22002
	AVERAGE	304	72	80	456	281	100	57	438	201	143	50	394	171	166	80	417	228	220

## APPENDIX X

*Copy of letter No. 3-2(7)/61-Agri. dated the 21st October, 1961 from the Planning Commission, Government of India, New Delhi, to the Development Commissioners/Planning Secretaries, All States.*

**SUBJECT.**—*Minor Irrigation Survey and Co-ordination of Major, Medium and Minor Irrigation Works.*

The major and medium irrigation works that are proposed to be taken up during the coming ten years are broadly known. The Central Water & Power Commission is preparing basin-wise reports on technological possibilities of irrigation projects showing the location of major projects, the irrigation potential of which is estimated at about 100 million acres. For minor irrigation, although the position in regard to the potentialities is not precisely known, a study on the subject of natural resources places the minor irrigation potential of the country at 75 million acres. A perspective view has, therefore, to be taken in regard to location of areas for major and minor irrigation schemes, and allocation of priorities as also funds for their execution by different agencies. District-wise information regarding the existing minor irrigation works is available in many of the States. However, there is distinct need for co-ordinating planning and investigation of future minor irrigation possibilities at the district level.

2. The need for undertaking systematic surveys was recognised by the Regional Minor Irrigation Conference held in 1958, who had recommended setting up of properly staffed and equipped investigation units with definite jurisdictions, for this purpose. The Annual Conference of Community Development held in Srinagar in 1960, had recommended that at district and the State Level, Offices of the irrigation and Agriculture and Planning Departments should assess the irrigation requirements and possibilities in the Block and prepare Plan of works to be undertaken. The States may have already initiated action in implementation of these recommendations.

3. In compact areas where large number of minor irrigation works are in existence, care will have to be taken to see that they are not wasted on account of the execution of new major and medium irrigation projects. Similarly, in intensifying efforts for undertaking new minor irrigation works it should be seen that such works are not concentrated in areas where adequate perennial irrigation will be available before long through major and medium irrigation works. It would also be worthwhile to combine the system of flow irrigation and lift irrigation so as to maximise the use of stored water over a larger area and obviate the danger of water-logging.

4. The minor irrigation works may include, among others, tanks, diversion channels lift irrigation works and tube or percolation wells. The State Governments may indicate location only in respect of such works as are estimated to irrigate more than 100 acres. In regard to the rest, only the number and the estimated area to be irrigated under each category of works in a block or the district should be shown. The State Governments may also consider listing in a separate category works which cannot be justified strictly on grounds of financial returns but are recommended for execution as relief works as and when the need for them arises.

5. It is suggested that the State Governments may kindly prepare irrigation maps for the State as a whole indicating areas which will be served (1) by major and medium irrigation, (2) minor irrigation schemes with or without soil conservation schemes and (3) by soil conservation schemes. Such maps should be ready as soon as possible, preferably, in about a year's time so that a co-ordinated irrigation programme for the country as a whole can be drawn up for use of all agencies concerned with the subject.