



GOVERNMENT OF MAHARASHTRA

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# A NOTE ON PREPARATION OF LIFT IRRIGATION SCHEMES

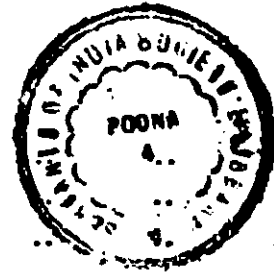
IRRIGATION AND POWER DEPARTMENT

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PRINTED AT THE GOVERNMENT CENTRAL PRESS, BOMBAY-4 : 1970  
Price—Rs. 10

**A NOTE  
ON  
PREPARATION OF  
LIFT IRRIGATION SCHEMES.**

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## APPENDIX I

*Typical Calculations of Horse Power.*

Discharge—2 cusecs

Total head—

(i) Static head .. .. .	..	Say 90 ft.
(ii) Frictional loss—		
(a) In suction pipe length 20' diameter 6" (from table IV) .. .. .	$\frac{9.9 \times 20}{100} =$	2.00
(b) In delivery pipe length 40', diameter 6" .. .. .	$\frac{9.9 \times 40}{100} =$	4.00
(c) In rising main length 3000 ft. diameter 12" (from table V) .. .. .	$2.2 \times 3 =$	6.60
(iii) Loss in valves, bends etc.—		
(a) Foot valve equivalent of 44' of 6" diameter pipe .. .. .	$\frac{9.9 \times 44}{100} =$	4.35
(b) Elbows 2 Nos. 6" diameter (from drg. 8) .. .. .	$\frac{2 \times 9.9 \times 16}{100} =$	3.16
(c) Reducer 6" $\times$ 5" (from drg. No. 8) .. .. .	$\frac{9.9 \times 10}{100} =$	0.99
(d) Sluice valve 6" diameter (from drg. No. 8) .. .. .	$\frac{9.9 \times 20}{100} =$	2.00
(e) Reflux valve equivalent length 44' of 6" diameter pipe .. .. .		4.35
(f) Reducer 12" $\times$ 6" (from drg. No. 8) .. .. .	$\frac{9.9 \times 11}{100} =$	1.00
	<hr/>	
Total ..	118.45 ft.	
Say ..	120 ft.	

$$\text{H. P. required } \frac{5 \times 2 \times 120}{44 \times 0.7} = 39$$

$$\text{Add for unforeseen 10 per cent } = \frac{4}{43}$$

The next available motor is of 50 H. P. Hence adopt 50 H. P. motor.

**APPENDIX II**

*Form of Estimate for Administrative Approval*

Name of work :									
Serial No.	Item	Description and Specifications.	Quantity	Rate		Unit	Amount		Remarks
				Rs.	P.		Rs.	P.	
1	2	3	4	5		6	7	8	
1	Intake Chamber	.. Circular in shape constructed in U. C. R. masonry/brick work* in c.m. 1:5 with cement pointing/plaster* to exposed faces. Internal diameter ..... Thickness of steining..... Depth of foundation below river bed..... Height above bed..... Foundation concrete 1:4:8, 150 mm. thick. R. C. C. slab 1:2:4, 150 mm. thick on top. Side grating with shutter and grating on top for admitting water.	One No.			No.		The rate includes cost of ring bund and dewatering.	
2	Inlet pipeline	.. Average depth of cutting of the trench— In soft and hard rocks..... In murum ..... In soil ..... Class of pipe—Special extra thick/NP-2*.				Metre		Rate includes cost of dewatering.	
3	Jack well/Dry well*	.. Construction in U.C.R. masonry/brick work* in c.m. 1:5 with cement pointing/plaster* to exposed faces. Internal diameter..... Depth of excavation below ground level— In soft and hard rock..... In murum..... In soil ..... Total height above foundations ..... Average thickness of steining..... Bottom concrete 1:4:8, 300 mm. thick. R. C. C. ring 300 mm. thick at top. Providing with 20 mm. M. S. bar U-shaped steps and R. S. Js. at mid-height for erecting platform.	One No.			No.		Rate includes cost of dewatering.	
4	Pump House	.. To be constructed on top of well, circular/square* in shape size ..... ..... Floor : Side walling :	One No.			No.			



8	Land Acquisition	.. Nature of land— (a) Bagayat (b) Jirayat (c) Waste	Acre Acres Acres
9	Pumping Machinery	.. Centrifugal/turbine* pumps..... Nos. having a capacity of.....g.p.m./c.p.m. each at a head of..... metres coupled directly/through V. belt/Vertical shaft* to horizontal/vertical electric motors/ diesel engine* of.....H. P. each. All accessories such as switch Boards, starters, sluice and reflux valves, foot valves, suction and delivery pipe, trees, Y-S, pressure gauges etc. as required. Including erection and all sundry materials.	H.P.
10	Chain Pulley block	.. Moving mono rail type for erection and removing of pumping machinery. Capacity.....tonnes.	One No.                      No.

Total .. \_\_\_\_\_  
 Add 3 per cent. contingencies.. \_\_\_\_\_  
 2 per cent. W. C. Establishment .. \_\_\_\_\_  
 Per cent. Agency charges .. \_\_\_\_\_  
 Grand total Rs. : : .. \_\_\_\_\_

\*Strike out whichever is not applicable.



## APPENDIX III

## Descriptive Note

Name of Scheme :—

River:—

Taluka:—

District:—

1. Location	..	..	..	..	..
2. Nearest railway station and distance	..	..	..	..	..
3. Nearest diesel depot (for diesel scheme) and distance	..	..	..	..	..
4. Nearest power line (for power scheme) and distance	..	..	..	..	..
5. Availability of water	..	..	..	..	..
Discharge available	..	..	..	..	..
(i) Kharif	..	..	..	..	..
(ii) Rabi	..	..	..	..	..
(iii) Hot weather	..	..	..	..	..
6. Area under command	..	..	..	..	..
7. Area proposed for irrigation	..	..	..	..	..
8. Crop pattern and discharge requirement—					

Serial No.	Name of crop	Area acres	Discharge required on hours basis			Remarks
			Kharif season Acres/Duty=Q	Rabi season Acres/Duty=Q	Hot weather Acres/Duty=Q	
1	2	3	4	5	6	7
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
		Total	..			

9. Design discharge (Q)	..	..	..	..
10. Salient levels (Arbitrary)—				
(i) River bed level	..	..	..	..
(ii) Low water level	..	..	..	..
(iii) Normal High flood level	..	..	..	..
(iv) Maximum High flood level	..	..	..	..
(v) F. S. L. in delivery chamber	..	..	..	..
11. Static Head 10 (v) minus 10 (ii)	..	..	..	..

12. Frictional and other losses—

- (i) Frictional loss in suction pipe
- (ii) Frictional loss in delivery pipe
- (iii) Head loss in rising main at ft./mt. per 1,000 ft./mt.
- (iv) Loss of head in bends, valves, reducers, etc.
- (v) Total

13. Gross Head (11+12) (H)

14. H. P. Calculations (H. P. =  $\frac{5QH}{448e}$  where e = efficiency of pump)

15. Description of pumping units

16. Rough cost (Rs.)

- (i) Civil portion
- (ii) Mechanical portion

Total Rs.

Agency charges at per cent.

Total Rs.

Rs.

17. Cost per acre

18. Benefit Cost Ratio

19. Water charges for different crops (Rs. per acres)—

Serial No.	Name of crop	Acre inches	Rate per acre inch	Amount	Irrigation charges or royalty	Total
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

20. Cement requirement (tonnes)

21. Remarks

## APPENDIX IV

*Electric power supply for Lift Irrigation Schemes by Maharashtra State Electricity Board (Tariff for Agricultural Pumping)*

The following information will be useful for estimating the cost of installations required for electric power supply and for working out the running expenses on account of electrical energy consumption for lift irrigation schemes.

**Type of supply**

1.01. Where the connecting load is 50 KW or less, the Maharashtra State Electricity Board gives a supply or low tension (400/440 volts). For higher connected loads, the supply given is of high tension.

**2.00. Overhead lines**

2.01. The Board provides overhead lines free of cost upto 300 metres from the nearest distributing point i.e. from an existing rural transformer sub-station or from a service line already laid for supply to any other consumer. If the length required is more than 300 metres, the balance has to be laid at the cost of the consumer. For the purpose of estimate, this extra length may be estimated at the rate of Rs. 6.56 per metre. If the service line does not terminate at a permanent structure of the consumer such as a building and if it becomes necessary to provide a terminal pole, the Board would charge an additional amount of Rs. 100.

2.02. A guarantee of three years for taking L. T. supply from the Board is required to be given. In the case of H. T. supply the required transmission line is laid by the Board at their cost provided the consumer gives a guarantee to take supply for a minimum period of seven years and pay annually 15 per cent. for hydro and diesel grid of the cost incurred in laying the entire line. This minimum guarantee will not however be less than the minimum charges prescribed under the relevant rate schedule.

2.03. When an isolate consumer or a group of consumers situated away from a sub-station require supply, it becomes necessary to extend the high tension line and set up a new rural transformer sub-station. In such cases, the Board would provide the necessary high tension line at their cost provided the connected load is not less than 15 H. P. and the consumer gives a guarantee to take electric supply for a period of not less than seven years and pay minimum annual charges as given in para. 3 above. The capital cost of giving supply may be calculated for estimate purpose as follows:—

- (1) Cost of extending H. T. line at Rs. 9,800 per mile.
- (2) Cost of transformer sub-station—  
50 KVA—Rs. 6,800.  
100 KVA — Rs. 8,900.
- (3) Cost of extending L. T. line at Rs. 6.56 per metre.
- (4) Service connection charges as given in para. 5.
- (5) Cost of terminal pole as given in para. 2.01.

**3.00. Transformer**

For high tension supply, the transformer at the consumers end has to be provided by the consumer. However, the Board would provide a transformer on hire for maximum period of six months provided it is available with them. The current rates of hire charges are the following:—

KVA	Charges for transport erection and dismantling	Hire charges		
		11KV	22 KV	33 KV
50	125	40	40	....
100	150	55	60	100
250	200	....	....	....
500	250	150	190	220

**4.00. Energy charges**

4.01. *Low tension supply.*—(1) Minimum charge of Rs. 40 per B.H.P. or part thereof of connected load per year subject to a minimum of Rs. 80 (i.e. a minimum load of 2 B.H.P. will be charged if the connected load is less than 2 B.H.P.).

If a consumer so desires and if his load is less than 2 B.H.P. but more than 1 B.H.P. he will be charged on the actual connected load on the condition that the free allowance for overhead line will be only 150 metres instead of 300 metres (see para. 2.01).

- (2) Meter rent Re. 1 per month.
- (3) Charge for units Consumed.

For the first 50 units consumed during a month per B. H. P. of connected load, 13 paise per unit.

For the next 150 units consumed during a month per B. H. P. of connected load per month 12 paise per unit.

For additional units consumed during the month—10 paise per unit.

- (4) plus Electricity duty at 4 paise per every 5 units.

4.02. *High tension supply.*—(a) Hydro Tariff—(i. e. places supplied with power from hydro power stations in Western Maharashtra excluding Khandesh).

**Demand charges.**—(1) 9 per KVA of billing demand per month for the first 1000 KVA.

(2) Rs. 8 per KVA of billing demand for next 1000 KVA.

(3) Meter rent Rs. 5 per month.

**Energy charges (in addition to demand charges).**—(1) For the first 150 units per KVA of billing demand per month 4 paise per unit.

(2) For the next 5,00,000 units consumed during a month 3·8 paise per unit.

(3) For the next 5,00,000 units consumed during the month 3·5 paise per unit.

(4) For additional units consumed during the month 3·2 paise per unit.

(5) Electricity duty at 4 paise per every 5 units.

(b) **Thermal Tariff.**—(i.e. places supplied with power from thermal power stations in Khandesh, Marathwada and Vidarbha.)

**Demand charges.**—Same as per hydro power tariff.

**Energy charges (in addition to demand charges).**—(1) For the first 100 units per KVA or 50,000 units whichever is greater per month—7 paise per unit.

(2) For the next 2,00,000 units consumed during a month—6 paise per unit.

(3) For the next 3,00,000 units 5 paise per unit.

(4) For additional units—4·25 paise per unit.

(5) Electricity duty at 4 paise per unit.

(6) Fuel cost adjustment charge depending upon rise or fall of fuel cost above or below Rs. 7 per million kilo-calories.

**4.03 Rates for seasonal supply.**—(a) **Hydro tariff.**—The seasonal consumers will have to pay a minimum annual bill at Rs. 100 per KVA of the maximum billing demand during the year or 75 per cent of connected load of 50 KVA whichever is higher. The year for this purpose is taken from 1st October to 30th September.

(b) **Thermal tariff.**—The same as above but the minimum rate will be Rs. 120 plus fuel cost adjustment charge on actual energy consumed.

#### 5.00. Service connection charges

The Board levies the following installation charges—

**Low tension supply.**—(1) For the loads more than 5 HP—Rs. 125.

(2) For loads 5 HP and less—Rs. 75.

**Deposit.**—Rs. 15 per H.P. or 3 months average consumption whichever is more.

**High tension supply.**—

(1) First 500 KVA	..	..	..	Rs. 1,000
(2) Next 500 KVA	..	..	..	Rs. 100 per 100 KVA or part.
(3) Balance	..	..	..	Rs. 50 per 100 KVA or part

#### 6.00. Testing charges

Testing charges for intallation and sub-station are required to be paid to Government. The current charges are as follow :—

Testing of installation i.e. Electric Motors, starters, switches, oilcircuit, breakers, etc.

Capacity					Fees. Rs.
Upto 5 Kw.	..	..	..	..	5-00
Upto 10 Kw.	..	..	..	..	7-50
Upto 20 Kw.	..	..	..	..	10-00
Uptp 50 Kw.	..	..	..	..	20-00
Upto 100 Kw.	..	..	..	..	30-00
Upto 500 Kw.	..	..	..	..	30-00 For first 100 Kw. plus Rs. 15-00 for every 50 Kw.
Uptp 1,500 Kw.	..	..	..	..	150-00 For the first 500 Kw plus Rs. 10-00 for every addition of 50 Kw.
Exceeding 1,500 Kw.	..	..	..	..	350-00

The fee shall be paid by the owner to whom energy is or is about to be supplied.

**Testing charges for transformer sub-stations.**

Capacity	Fees
	Rs.
Upto 25 Kw.	25-00
Upto 50 Kw.	50-00
Upto 100 Kw.	35-00
Upto 250 Kw.	125-00
Upto 500 Kw.	175-00
Upto 750 Kw.	225-00
Upto 1,000 Kw.	275-00
Exceeding 1,000 Kw.	300-00

Fees shall be paid by receiving party.

These charges are required to be paid every year.

**7.00 : Billing Demand**

Billing demand means the maximum of the following :—

- (1) The maximum demand established during the month i.e. the average KW/KVA supplied during 30 minute period of maximum use during the month.
- (2) 75 per cent. of the contract demand i.e. the maximum KW/KVA for the supply of which the Board undertakes to provide.

## APPENDIX V

## Calculations of water rates

The following calculations of water rates are given for guidance and they are for a hypothetical scheme with the following assumed data :—

(i) Irrigable area	..	..	..	500 acres.
(ii) Cropping pattern	..	..	..	As given in calculations.
(iii) Static lift	..	..	..	70 ft.
(iv) Gross lift	..	..	..	90 ft.
(v) Pumping capacity	..	..	..	7 cusecs (perennial scheme).
				6 cusecs (non-perennial scheme).
(vi) Horse power	..	..	..	120 (perennial scheme).
				110 (non-perennial scheme).

## (vii) Cost :—

## Electric Power—

## A. Perennial Scheme—

									Rs.
(i) Civil part	..	..	..	..	..	..	..	..	1,11,000
(ii) Mechanical part	..	..	..	..	..	..	..	..	1,89,000

Total .. 3,00,000

## B. Non-Perennial Scheme—

(i) Civil part	..	..	..	..	..	..	..	..	1,11,000
(ii) Mechanical part	..	..	..	..	..	..	..	..	1,39,000

Total .. 2,50,000

## Diesel Power—

## C. Perennial Scheme—

(i) Civil part	..	..	..	..	..	..	..	..	1,11,000
(ii) Mechanical part	..	..	..	..	..	..	..	..	2,25,000

Total .. 3,36,000

## D. Non-Perennial Scheme—

(i) Civil part	..	..	..	..	..	..	..	..	1,11,000
(ii) Mechanical part	..	..	..	..	..	..	..	..	1,75,000

Total .. 2,86,000

## A. Perennial Scheme with Electric Power

## 1. Direct (running) charges—

## (i) Total water to be pumped—

Crop	Area	No. of waterings	Inch depth	Acre inches <sub>±</sub>
<i>Kharif season (July to September)</i>				
Sugarcane	100	4	3	1,200
Other perennials	25	4	2.5	250
Paddy	50	2	4	400
G. Nut	50	2	3	300
Cotton	25	2	3	150
Jowar	100	2	3	600
Hy. Jowar	100	3	3	900
	<u>450</u>			<u>3,800</u>
<i>Rabi season (October to February)</i>				
Wheat	100	6	3	1,800
Hy. Jowar	175	6	3	3,150
Cotton	25	2	3	150
G. Manure	200	2	3	1,200
Sugarcane	100	17	3.5	5,950
Other perennials	25	12	2.5	750
	<u>625</u>			<u>13,000</u>
<i>Hot Weather season (March to June)</i>				
Cotton	25	7	3	525
Sugarcane	100	12	4.5	5,400
Other perennials	25	12	3	900
	<u>150</u>			<u>6,825</u>

Total for the year 23,625 acre inches.

## (ii) No. of working hours (Acre inches divided by cusecs)

Kharif	..	..	..	..	$\frac{3800}{7} = 543$
Rabi	..	..	..	..	$\frac{13000}{7} = 1857$
Hot weather	..	..	..	..	$\frac{6825}{7} = 975$
Total for the year				..	<u>3375 hours</u>

## (iii) Consumption of electricity

H.P. = 120

Assuming 90 per cent efficiency of motors

$$\text{Input} = 0.746 \times 120 \times \frac{100}{90}$$

$$= 99.6 \text{ say } 100 \text{ K.W.}$$

$$\text{KVA} = \frac{120 \times 0.746}{0.85} = 105 \text{ (Assuming a power factor of } 0.85)$$

Units consumed

Kharif (July to September)

$$543 \times 100 = 54,300$$

i.e. 27,150 units per month (pumping for 2 months only)

Rabi (October to February)

$$1857 \times 100 = 1,85,700$$

i.e. 37,140 per month

Hot Weather (March to June)

$$975 \times 100 = 97,500$$

i.e. 24,375 per month

## (iv) Energy charges (H.T. supply)

$$(i) \text{ Demand charge—} 12 \times 9 \times 105 = 11,340$$

(ii) Energy charge—

$$\text{Kharif—first } 15,750 \text{ (} 105 \times 150 \text{) units @ } 0.04 = 630$$

$$\text{Remaining } 11,400 \text{ @ } 0.038 = 433$$

$$\underline{27,150}$$

$$2 \times 1063 = 2126$$

$$\text{Rabi First } 15,750 \text{ units @ } 0.04 = 630$$

$$\text{Remaining } 21,290 \text{ units @ } 0.038 = 813$$

$$\underline{37,140}$$

$$5 \times 1,433 = 7,215$$

$$\text{Hot weather First } 15,750 \text{ units @ } 0.04 = 630$$

$$\text{Remaining } 8,625 \text{ units @ } 0.038 = 328$$

$$\underline{24,375}$$

$$4 \times 958 = 3,832$$

Total .. 24,513

Electricity duty @ 0.04 per 5 units.

$$337500 \times 0.04 = 2700$$

5

Meter rent @ Rs. 5 per month

$$12 \times 5 = 60$$

Total per year	24513	+	Elcc. duty	2,700	+	Meter rent	60	=	27,273
----------------	-------	---	------------	-------	---	------------	----	---	--------

(This is more than minimum charge of Rs. 100 × 105 KVA)

Cost per acre inch = 27,273

$$\frac{27,273}{100} = \text{Rs. } 1.15$$

## 2. Fixed charges (Government Scheme)—

(i) Depreciation as annual contribution to a sinking fund, etc.

(a) Civil part 1,398 @ 1.26 per cent.

(b) Mech. 9,337 @ 4.94 per cent.

(ii) Interest 16,500 @ 5½ per cent.

(iii) Maintenance at 3 per cent on machinery

$$\frac{1,89,000 \times 3}{100} = 5,670$$

(iv) Maintenance at 1½ per cent on civil works

$$\frac{1,11,000 \times 1.5}{100} = 1,665$$

(v) Staff for running the scheme 2,000

Total 36,568

Cost per acre inch = Rs. 1.55

3. Total cost per acre inch =  $1.15 + 1.55 = \text{Rs. } 2.70$

4. Water rates—

Crop	Acres	Rate	Amount	Irrigation charges	Total
1	2	3	4	5	6
1. Sugarcane .. ..	125.5	2.70	339	40	379
2. Other perennials .. ..	76	2.70	202	25	227
3. Paddy .. ..	8	2.70	22	....	22
4. Groundnut .. ..	6	2.70	16	6	22
5. Green Manure, K. Jowar .. ..	6	2.70	16	....	16
6. Hy. Jowar (K) .. ..	9	2.70	24	....	24
7. Wheat & Hy. Jowar (R) .. ..	18	2.70	49	....	49
8. Cotton .. ..	33	2.70	89	33	122

**B. Non-Perennial Scheme with Electric Power**

1. Direct (running) charges—

(i) Total water to be pumped—

Crop	Area	No. of waterings	Inch depth	Acres
1	2	3	4	5
Kharif season (July to September)				
1. Paddy .. ..	50	2	4	400
2. Groundnut .. ..	50	2	3	300
3. Jowar .. ..	250	2	3	1,500
4. H.B. Jowar .. ..	150	3	3	1,350
	500			3,550
Rabi season (October to February)				
5. Wheat .. ..	100	6	3	1,800
6. H.B. Jowar .. ..	325	6	3	5,850
7. G. Manure .. ..	325	2	3	1,950
	750			9,600
Hot weather season (March to June)				
Nil				
Total for the year 13,150 acre inches.				

(ii) No. of working hours (acre inches divided by cusecs)—

Kharif	$\frac{3550}{6}$	=	592
Rabi	$\frac{9600}{6}$	=	1600
Hot weather	....	....	
Total for the year		=	2192 hours

(iii) Consumption of electricity—

$$\text{K.W.} = 0.746 \times 110 = 82.06$$

$$\text{Input} = 82 \times \frac{100}{90} = 91.1 \text{ K.W. say } 91 \text{ K.W.}$$

$$\text{KVA} = \frac{110 \times 0.746}{0.85} = 97$$

Units consumed—

$$\text{Kharif } 592 \times 91 = 53,872 \text{ i.e. } 26,936 \text{ per month.}$$

$$\text{Rabi } 1600 \times 91 = 1,45,600 \text{ i.e. } 29,120 \text{ per month.}$$

Hot weather—Nil.



## (iv) Energy charges (H. T. Supply)—

(i) Demand charge— $8 \times 9 \times 97 = 6,984$ 

(ii) Energy charge

Kharif—First 14,550 (97 × 150) units at Rs. 0.04 = 582

Remaining	12,386		
	26,936		at Rs. 0.038 $\frac{= 471}{2 \times 1,053} = 2106$

Rabi—First 14550 units	14,570		
Remaining	29,120		at Rs. 0.038 $\frac{582}{5 \times 1,136} = 554$

Hot weather—Nil

Total 14,770

Energy charge		Elec. duty		Meter rent.	
Total per year = 14,770	+	596	+	60	= 15,426

(This is more than the minimum charge of Rs. 100 × 97 KVA)

Cost per acre inch =  $\frac{15,426}{13,150} = \text{Rs. } 1.17$

## 2. Fixed charges.—(for scheme in State of Local Sector)

(i) (a) Depreciation calculated as annual contribution to a sinking fund bearing interest at 5 per cent—

Civil part (life 40 years) =  $0.0126 \times 1,11,000 = 1,398$ 

Mechanical part (life 15 years) =  $0.0494 \times 1,39,000 = 6,867$   
8,265

(b) Interest at  $5\frac{1}{2}$  per cent  $\frac{2,50,000 \times 5.5}{100} = \frac{13,750}{22,015}$ (ii) Maintenance at 3 per cent on machinery  $\frac{1,39,000 \times 3}{100} = 4,170$ (iii) Maintenance at  $1\frac{1}{2}$  per cent on civil works  $\frac{1,11,000 \times 1.5}{100} = 1,665$ (iv) Staff for running the scheme =  $\frac{2,000}{29,850}$ 

• Cost per acre inch =  $\frac{29,850}{13,150} = \text{Rs. } 2.27$

3. Total cost per acre inch =  $1.17 \times 2.27 = \text{Rs. } 3.44$ 

## 4. Water rates

Crop	Acres	Rate	Amount	Irrigation charges	Total
1	2	3	4	5	6
1. Paddy .. .. .	8	3.44	28	6	28
2. Groundnut .. .. .	6	3.44	21	6	27
3. Jowar (K) & Green Manure .. .. .	6	3.44	21	6	21
4. Hy. Jowar (K) .. .. .	9	3.44	31	6	31
5. Wheat (R) & Hy. Jowar (R) .. .. .	18	3.44	62	6	62

## C. Perennial Scheme with Diesel Power

(i) Direct (running) charges

(i) Total water to be pumped

Same as per A-Perennial Scheme with Electric Power = 23,625 Acre inches.

(ii) No. of working hours.

Same as per A-Perennial Scheme with Electric Power = 3,375 Hours.

(iii) Cost of fuel consumption

H. P. = 120

Consumption of low Diesel oil (crude oil) specific gravity 0.86 is 0.5 lb. per B.H.P. Hour.

∴ Quantity of L.D. O. in lbs.

= H.P. × total working hours × rate of oil consumption per B.H.P. Hour.

=  $120 \times 3,375 \times 0.50 = 202,500$  lbs.

The rate of L.D.O. per lb. including transport charges upto pumping station = Rs. 0.21.

∴ cost of L.D.O. =  $2,02,500 \times 0.21 = \text{Rs. } 42,525$ .

for consumption of lubricating oil etc. add 25 per cent of cost for L.D.O.

∴ Total cost of running =  $42,525 + 10,631 = 53,156$ 

cost per acre inch =  $\frac{53,156}{23,625} = \text{Rs. } 2.25$

## 2. Fixed charges

## Government Scheme

## (i) Depreciation—

(a) Civil	1,398
Mechanical	1,115
(b) Interest	18,480

(ii) Maintenance at 3 per cent on machinery	
$\frac{2,25,000 \times 3}{100}$	6,750

(iii) Maintenance at 1½ per cent on civil works	
$\frac{1,11,000 \times 1.5}{100}$	1,665

(iv) Staff for running the scheme	2,000
Cost per acre inch =	$\frac{41,408}{Rs. 1.75}$

3. Total cost per acre inch =  $2.25 + 1.75 = Rs. 4.00$

## 4. Water rates—

Crop	Acres	Acres inches	Rate	Amount	Irrigation charges	Total
1	2	3	4	5	6	7
1. Sugarcane	125.5	125.5	4	502	40	542
2. Other perennials	76	76	4	304	25	329
3. Paddy	8	8	4	32	....	32
4. Groundnut	6	6	4	24	6	30
5. Green Manure, K. Jowar	6	6	4	24	....	24
6. Hy. Jowar (K)	9	9	4	36	....	36
7. Wheat and Hy. Jowar (R)	18	18	4	72	....	72
8. Cotton	33	33	4	132	33	165

## 1) Non-perennial Scheme with Diesel Power

## (i) Direct (Running) charges—

Total water to be pumped.

Same as per B-Non-perennial Scheme with Electric Power = 13,150 Acres inches.

## (ii) Number of working hours—

Same as per B-Non-perennial Scheme with Electric Power = 2,192 hours.

## (iii) Cost of fuel consumption—

H.P. = 110.

Consumption of Low Diesel Oil (Crude oil).

Special gravity 0.86 is 0.50 lbs. per B. H. P. hour.

∴ Quantity of L. D. O. in lbs.

= H.P. × Total working hours × rate of oil consumption per B. H. P. hour.

=  $110 \times 2,192 \times 0.5$ .

= 1,20,560 lbs.

The rate of L. D. O. per lbs. including transport charges up to pumping station = Rs. 0.21

Cost of L. D. O. =  $1,20,560 \times 0.21 = Rs. 25,318$ .

For Lubrication oil etc. add 25 per cent of cost of L. D. O. = Rs. 6,330

31,648

Cost per acre inch  $\frac{31,648}{13,150} = Rs. 2.40$

(2) *Fixed charges.*—(For the scheme in state or local sector)

(i) (a) Depreciation calculated as annual contribution to a sinking fund bearing interest at 5 per cent.

$$\text{Civil part (life 40 years)} = 0.0126 \times 1,11,000 \\ = 1,398$$

$$\text{Mech. part (life 15 years)} = 0.0494 \times 1,75,000$$

$$\text{Total} = \frac{8,645}{10,043}$$

$$(b) \text{ Interest at } 5\frac{1}{2} \text{ per cent} = \frac{2,86,000 \times 5.5}{100} = \frac{15,730}{25,773}$$

(ii) Maintenance at 3 per cent on machinery

$$\frac{1,75,000 \times 3}{100} = 52,50$$

(iii) Maintenance at 1½ per cent on Civil works—

$$\frac{1,11,000 \times 1.5}{100} = 1,665$$

(iv) Staff for running the schemes =  $\frac{2,000}{34,688}$ 

$$\text{Cost per acre inch} = \frac{34,688}{13,150} = \text{Rs. } 2.64$$

(3) Total cost per acre inch = 2.40 + 2.64 = Rs. 5.04

## (4) Water rates—

	Crop	Acre inches	Rate	Amount	Irrigation charges	Total
	1	2	3	4	5	6
1.	Paddy	8	5.04	41	....	41
2.	Groundnut	6	5.04	30	6	36
3.	Jowar (k) and Green Manure	6	5.04	30	....	30
4.	Hy. Jowar (k)	9	5.04	45	....	45
5.	Wheat (R) and Hy. Jowar (R)	18	5.04	91	....	91

## APPENDIX VI

## Typical calculations of benefit cost ratio

Assume irrigable area 500 acres.

$$\text{Benefit cost ratio} = \frac{A}{B}$$

A. represents annual net benefit.

B. represents annual cost.

A. Annual net benefit :—

## (1) Value of irrigated produce

Serial No.	Name of Crop	Area in acres	Value of net produce in Rs. per acre (Table IX)	Amount Rs.
1	2	3	4	5
1	Sugarcane	100	879	87,900
2	Other perennials	25	304	7,600
3	Cotton L. S.	25	510	12,750
<i>Kharif Seasonals</i>				
4	Paddy	50	220	11,000
5	Groundnut	50	385	19,250
6	Jowar	100	150	15,000
7	Hy. Jowar	100	225	22,500
<i>Rabi Seasonals</i>				
8	Wheat	100	126	12,600
9	Hy. Jowar	175	225	39,375
10	Green Manure	200	21	4,200
				2,32,175

## (II) Deduct value of existing (unirrigated) produce

An existing (before irrigation) cropping pattern is assumed and the value of existing crop is worked out as per statement attached which comes to Rs. 40,290.00.

Thousand Rs.

I. Value of irrigated produce	..	..	..	..	..	..	232.2	
II. Value of unirrigated produce	..	..	..	..	..	..	40.3	
							Net benefit	
							..	191.9

B. Annual cost (from Appendix VI)—

(a) Direct (running) charges	..	..	..	..	..	..	27,273
(b) Fixed charges	..	..	..	..	..	..	36,568
(c) Administrative charges at Rs. 5 per acre for 500 acres	..	..	..	..	..	..	2,500
							66,341

$$\therefore \text{Benefit cost ratio} = \frac{A}{B} = \frac{191.9}{66.34} = 2.90$$

## ACCOMPANIMENT TO APPENDIX VI

Serial No.	Name of Crop	Per cent of existing crops	Area in acres	Produce in quintals per acre Table No. X	Net benefit per quintal (Rs.) Table No. VIII	Net benefit per acre (Rs.) Column 5 × 6	Net benefit in Rs. for the area in Column 4
1	2	3	4	5	6	7	8
1	Jowar (K)	30	150	3.07 Q.	30.9	94.36	14,229
2	Groundnut (K)	16	80	2.88 Q.	50.6	145.73	11,658
3	Bajari (K)	22	110	0.77 Q.	21.6	16.63	1,829
4	Tobacco (K and R)	5	25	2.05 Q.	91.1	186.76	4,669
5	Wheat (R)	2	10	2.08 Q.	38.7	80.50	805
6	Gram (R)	3	15	1.57 Q.	17.7	27.79	417
7	Jowar (R)	10	50	3.07 Q.	30.9	94.86	4,743
8	Grass	4	20	....	....	9.00	180
9	Tur	3	15	2.86 Q.	23.6	67.50	1,013
10	Other pulses	5	25	1.12 Q.	26.7	29.90	747
		100	500				40,290

Say 40.3 thousand