Chapter - V

ALTERNATIVE SOURCES - AVAILABILITY AND VIABILITY

5.0 Other Sources and Their Status :

The alternate sources of minor irrigation in Panchmahals are class II irrigation tanks (with maximum command of 100 hectares), Lift Irrigation schemes, check dams and wells. There are significant number of porcolation tanks which are supposed to raise the water tables in the nearby areas but they do not facilitate direct flow irrigation. We shall briefly discuss the status of each source.

Class II Irrigation Tanks :

By definition second class irrigation works are those which irrigate area of less than 250 acres. The administrative control of such works is with the Revenue authorities like Malatdar or Mahalkari. The day-to-day repairs such as filling the ruts and hollows, clearing jungle and clearing silt from irrigation canals and waste weir, channels are done by the beneficiaries themselves. For such works water rates are not levied separately but are recovered by way of 'Himyat' which constitutes fixed charges per acre recovered alongwith the land revenue taking into consideration the advantage occuring from such irrigation works.[1]

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1 Glossary of Irrigation Terms , Public Works Department, Sachivalaya, Gandhinagar, 1976.

The size is not the only criterion. The most important difference between Class I and Class II tanks is the management. It is designed and constructed by MI division and then handed over to the lower level administrative authorities. It is a recent practice that management is handed over to taluka Panchayats (block level political body with government staff support headed by Taluka/Block Development Officer). We have considered second class tank as an alternative source because the management is more nearer to the users - atleast by design. The maintenance and operation is almost in the hands of beneficiaries themselves. One would expect a different and positive trend in utilization of this source.

Table 5.1

Class II Irrigation Tanks in Panchmahals

(Area in Hectares, Total cost in lakhs of Rs.)

Particulars	Completed works	On-going works	Proposed works
1	2	3	4
1. Number of works	117	13	20
2. Total cost (estimated)	112.27	14.63	46.79
3. Total potential Command	4538	307	255
4. Cost per hectare (in Rs.)	2473	4765	18349

Source: Compiled from Master Plan - Minor Irrigation Division, Godhra, 1979.

Most of the sites have been exploited. This is the impression one gets after looking at table 5.1. Class II tanks are taken up mainly in the scarcity hit areas. From 1974-75 onwards, the district has not experienced a severe drought. It is true that class II irrigation tanks are slowly becoming less and less popular. The cost of construction is going very fast. Especially, the cost of proposed works is exorbitant.

Except management all the characteristics which describe the class I irrigation tanks and their utilization also apply for second class tanks. We shall stop at that. We shall briefly comment on management and then move to the next alternative. Thought it was thought that a higher degree of peoples participation would ensure better and efficient management, the factual details show reverse trends. Management alone is however, not responsible for the non-performance of the tanks. When all the Taluka Development Officers were requested to send utilization abstract for second class irrigation tank under their authorities, we received interesting replies.

Some of the officers could not send utilization abstracts as they were not aware if such records were maintained in their offices. Some of them sent the replies but they contained the reasons for non-utilization of the tanks. Some of them also sent us notes which said that the taluka panchayat bodies had very meagre funds and were unable to maintain the irrigation tanks. The major technical problems found in second class irrigation tanks were :

(a) Leakage at head works and gates;

(b) Damage at waste weir;

(c) Breaches in Canal;

(d) Porus tank beds;

(e) Silting.

Information collected from three talukas suggest that 45 tanks in these talukas had problems. For rest of the tanks the information did not come. Devagadh Baria, Zalod, Dahod, Kalol, Shehera and Godhra TDOs sent us some information on Class II tanks. The utilizatinn in most of the tanks is extremely poor.

Table 5.2

Utilization Abstract of Class II tanks in Panchmahals

Sr. No.	Name of taluka and no. of tanks		Potential Command in hectares	Actual Area Irrigated in hectares			
				1974-75	1975-76	1976-77	1977-78
1	2		3	4	5	6	7
1.	Godhra	(8)	426	Nil	25	25	137
2.	Shehera	(3)	N.K.	Nil	Nil	Nil	Nil
3.	DevgadhBaria	(9)	262	10.69	26.44	12.95	2.4
4.	Dahod	(11)	457	Nil	Nil	Nil	Nil
5.	Zalod	(17)	976	Nil	Nil	Nil	Nil
6.	Jambughoda	(3)	161	-	3	20	-
7.	Santrampur	(7)	N.K.	-	6.9	10.30	11.41
	Total	(58)	2282	10.69	61.34	68.25	150.81

N.K. = Not known

Source: Taluka Development Offices, Panchmahals District.

In rest of the talukas the second class tanks are almost defunct. In Dahod and Zalod there is some irrigation but not on record. The cultivators manage themselves. The village level revenue official viz., the talati is taken into confidence and the cultivators at the head of Canal (which is poorly laid) utilize water. The farmers usually do not pay anything for this.

As far as maintenance is concerned, the tanks, in most cases, must not have seen a bag of cement after the construction. The taluka/block level bodies do not have enough funds to run their own administration and hence they cannot spend anything on tank maintenance. Decentralized management in Panchmahals is marred by ineffective public participation and shortage of funds. To conclude the case of second class irrigation works we can say that they are a bunch of subjectively identified, carelessly designed, clumsily implemented and most inefficiently managed irrigation works. The taluka level body realizing this had once thought that the second class irrigation tanks management should be handed over to the MI Division at district level. The Taluka Panchayat Presidents were of the opinion that the cultivators in the district are yet to have a forward outlook and entrepreneural capacities to independently manage the irrigation works like tanks.*

Though the Master Plan data tells us that not many works are proposed for future, the latest decentralization of planning

* The author had series of discussion with the Taluka Panchayat Presidents of Devgadh Baria, Shehera, Dahod and Lunawada.

process in Gujarat State has given vent to the local representatives in presenting their ideas on planning. The proposals made by these members for 1980-81 contained second class and first class irrigation tank proposals worth Rs.540 million constituting 40% of the total proposed investment.[2] Some of the representatives felt that all the village tanks must be converted into irrigation tanks. This is the factor which increases the importance of our analysis and our interest in class II tanks.

Lift Irrigation Schemes :

A scheme that ensures water raising by pumps or other devices to apply water to the areas that are too high for flow irrigation is known as a lift irrigation scheme (LI Scheme). Public investment in LI schemes have been mainly to tap surface water. A jackwell dug in the river bed collects water which is lifted up by pumps and supplied to fields with a network of pipelines. The investment in tube wells has been very insignificant.

Lifting Water from River bed or Kotars (Ravines).

The position of this type of LI schemes is as follows :

2 District Planning Board, Panchmahals District, Proceedings of the General Body meeting, July,1981.

Table 5.3

Status of Lift Irrigation Schemes in Panchmahals

Particulars	completed works	Ongoing works	Proposed works
1	2	3	4
Number of Works.	5	24	46
Total cost Estimated in lakhs of Rupees.	13.48	52.81	123.00
Total potential command in Hectares	1170	2753	4980
Cost per hectare in Rs.	1152	1981	2470

Source : Compiled from : Master Plan M I Division, Godhra, 1979.

The construction of Lift Irrigation schmes in the district is on low key. There are only 5 works which have been completed and the cost has been much higher than the estimates. The LI schemes are faced with the problem of management. The MI Division has constructed only three schemes till the last information released (1979). 4 schemes were constructed by a private organization. The management of LI schemes is not with the MI division. In three schemes the management was handed over to the command beneficiaries cooperative society. In case of 4 privately constructed scheme the management is retained by the organization.

The schemes managed by cooperatives are almost defunct. There have been interpersonal problems on the issues of water distribution and hence the utilization is very poor.[3] It has not been possible to obtain the utilization statistics for the LI schemes operated and managed by cooperatives. The failure of management has led to slowing down of LI scheme construction.

LI Schemes under Private Management :

The 4 successful LI schemes operating in the district have been constructed and covered under the 'Rural Development Programme' managed by the Surat Cotton Mills and The Standard Mills Ltd. A voluntary agency viz., The Sadguru Seva Sangh Trust organised by the industrial tycoon 'Mafatlals' has promoted the activity in Panchmahals. The two mills mentioned above are from Mafatlal group.

The details of the 4 LI schemes, for which the capital grant was given by (included in the MI Division Budgeted works) Government of Gujarat, are as under :

"Three of the four Lift Irrigation proposals, were on good tanks in the villages Kathla, Vadbara, and Shankerpura. The fourth proposal was on River Anas at village Rampura in Jhalod taluka. The primary data of these lift irrigation schemes is shown below in Tables 5.4 and 5.5. The data shows the capital cost, pumping capacity, designed command etc.

3 For details kindly refer, S.Iyengar edited. A Preliminary Study of some of the Existing Projects. District Project Planning Cell Panchmahals, Godhra, December,1978 (Mimeo).

4 The Lift Irrigation Schemes in Panchmahals, R D Project Office, Dahod, April, 1982.

Table 5.4

Status of Privately Managed LI Schemes in Panchmahals

Name of the Scheme	Year of commissioning	Installed pumping capacity in HP	Capital cost in Rs. lakhs	Ultimate command in acres			
				Kharif	Rabi	Summer	Total
1	2	3	4	5	6	7	8
Kathla	1977-78	118	4.17	400	400	100	900
Vadbara	1977-78	48	2.57	200	200	75	475
Shankerpura	1976-77	118	3.36	300	300	75	675
Anas River	1980-81	432	18.00	900	900	-	1800
Total		716	28.10	1800	1800	250	3850

Source: The Lift Irrigation Schemes in Panchmahals", R D Project, Dahod, Panchmahals

Table 5.5

Utilization Abstract of the LI Schemes Managed Privately in Panchmahals

Name of the schemes	Total potential command in Rs., acres	Total Actual Irrigation in Acres		
		1979-80	1980-81	1981-82
1	2	3	4	5
Kathla	900	196	175	175
Vadbara	475	136	102	125
Shankerpura	675	221	250	250
Anas River	1800	-	400	400

Source: Compiled from: The Lift Irrigation Schemes in Panchmahals, R D Project, Dahod.

The structure that stands on the Anas River is an elegant device that lifts water. The scheme has a two stage lifting mechanism. The powerful engines go to explain that. They are all very recent schemes and hence any comment on utilization trend would be too hasty an attempt. However, following features draw attention.

There is in all 25% utilization. Of the 3850 acres of designed command, a maximum of 950 acres was irrigated in the year 1981-82. This has been possible because of a very superior management by the professional people involved. Their approach was different and the intentions were more than purely profit orientation. To quote in their own words, "In a backward area like Panchmahals, where the people are extremely poor, and cannot bank upon anything for their other requirements, the provision of irrigation alone is not enough. Along with irrigation, these farmers require so many other services and assistance. In view of this situation, in our Lift Irrigation Schemes, besides providing irrigation, the package of all necessary services are also provided by above Companies".[5] The management charges cultivators only for fuel. Rest of the expenses are borne by the management. A superior performance and an added benefit to the farmers can be explained but with high actual subsidies offered. There are some difficulties in LI schemes also. We shall attend to it in next sections. Presently we come to another indirect source viz., the check-dams.

5 R.D. Project, Dahod's, op.cit., pp.5-6.

Check Dams :

"Check dam is a low weir without a canal off taking from it, but affording facility for lift irrigation and also firming up, by means of percolation, irrigation under the wells in the surrounding area. It also helps in recharging the aquifers which are depleted by wells, tubewells etc."[6]

The MI division designs and implements the check dam schemes. The management is left with the Gram Panchayat - Village level public body. The department assumes that average command of the check dam to be of 10 hectares. We do not know how it is arrived at.

Table 5.6

Check Dams in Panchmahals

Particulars	completed works	Ongoing works	Proposed works
1	2	3	4
Number of Works.	79	37	151
Total cost estimated in lakhs of Rs.	38.14	22.43	153.87
Total Potential Command (in Hectares)	790	370	1510
Cost per hectare	4828	6062	10910

Compiled from: Master Plan M I Division, Godhra, 1979.

6 Manual on Design of Check Dams : Public Works Department, Sachivalaya, Gandhinagar, Gujarat, 1976.

Check dams have in general two problems. Firstly, the maintenance of check dams is found to be extremely poor, The wooden needles which are provided above the sill of check dams between piers give away very soon. There is also a continuous threat of theft of these needles. In some cases the first monsoon flood is so powerful that entire structure is washed away. Neeles are first casuality in those events. The gram panchayats are hardly capable to replace these needles. It is believed that half of the completed check dams have no needles.*
One does not know whether the stability analysis is not properly carried out and/or earther flanks are neglected (since this will raise the cost) or due to some other technical reason, the check dams are not significantly augmenting irrigation capacity.

Secondly, the cultivators are expected to lift water from the stream and then irrigate their fields. This invariably calls for motive power. The farmers will have to make an additional investment either individually or jointly to obtain a diesel engine or an electric pump-set (assuming he can get electricity). For making a substantial investment, the farmer should be sure of the supply of water. If the check dam has technical problems then the investment is not likely to take place. Then one will have to be content with the rise in water table in the nearby wells. There are no estimate available on this count.

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* Communicated privately by Sub-division supervisor of Godhra Sub-division.

Percolation Tanks :

"Percolation tank is defined as a small tank whose capacity does not exceed about 2.83 lakh cmt. (10 Mcft) and constructed by means of an earthen bund across a rivulet. The function of such a tank would be head-up water for a period and let it gradually escape to raise the surrounding sub-soil water level and produce a small and more permanent flow in the nalla, below the tank".[7]

The PWD Manual fails to state the extent of area which can get affected by the percolation tank. It only says, "they help to augment the sub-soil water, thereby stabilizing the irrigation practice from the wells in the area down stream of the tank within a reasonable distance."[8] Such subjectivity helps manipulation while identification, formulation and appraisal. However on page 2 of the Manual an approximate figure of 1 mile (1.6 kilmeters) is given. The Manual says, "the anticipated benefits should therefore, be worked out by ascertaining the number of wells which will be benefitted within a distance of one mile below dam".[9]

The percolation tanks are popular item for expenditure at district level. It creates on the spot employment and expenditure is booked rather easily. There is no benefit-cost criteria for this project and appraisal is mainly on the technical feasibility.

7 Manual on Percolation Tanks: Public Works Department, Sachivalaya, Gandhinagar, Gujarat State, 1976.
8 Ibid, p.1,
9 Ibid, p.2.

Potentially, a percolation tank may be beneficial in the areas where flow irrigation through gravity is not possible because of elevations. One should however check the number of wells in the probable command.

Table 5.7

Status of Percolation Tanks in Panchmahals

Particulars	Completed Works	Ongoing Works	Proposed Works
1	2	3	4
No.of works	53	7	31
Total cost Estimated in lakhs Rs.	86.88	8.22	88.00
Affected Area* in down stream in acres	33920	4480	19840
Cost per acre in Rs.	256	183	444
Total storage in Mcft.	570.15	37.30	Not Estimated

Note: * Affected area has been calculated by the author assuming that each tank will affect 1 square mile down stream (1 acre=4840 squar yards)

Source : Compiled from Master Plan M I Division, Godhra, 1979.

The most important factor is the number of wells in 1 sq. mile area in the downstream. The related aspect is the soil characteristic. If the sub-soil is permeable then the water table and moisture conservation will improve. If it is not then the benefits will be decreased. Like the second class irrigation tanks, the percolation tanks also have problems in construction and management. The department hardly pays any attention to desilting and other maintenance.

The percolation tanks also entail additional private investment in utilizing the increased yields from well. The action on the part of government alone does not guaranty significant rise in benefits. The protection argument once again has a limited significance since the storage in the reservoir will depend upon the rainfall in catchment. One must, therefore, ascertain the social benefit in a cautious manner. The projects have been identified and implemented with a general assumption that indirect benefits from percolation tanks are higher from the costs which are incurred. We shall examine this in the next sections.

Tubewells :

Information available on Tubewells is scanty. The Master Plan of MI Division, Godhra shows 2 completed works. Neither the cost estimates are given nor the command area. In proposed works, there are proposals for about 200 tubewells with an uniform cost of Rs.1.50 lakhs each and an uniform command of 25 hectares. By way of cost and command, we can say that these must be shallow tubewells. No details about the average depth etc. are available. Discussion with the technical authorities revealed that technically there is very little scope for tubewell irrigation.[9] There is no authentic and documented information on this. One also

9 Preface of the Master Plan MI Division, Godhra, 1979.

fails to understand how 200 of them have been proposed.*

Shallow Dugwells: Dugwells are in the domain of private sector. The government provides subsidy and loan facilities for digging a new well, for converting a non-masonary well into a masonary well and to deepen the well with the help of explosives. Wells in Panchmahals are shallow in depth and broad in diameter. They irrigated relatively less area.

Table-5.8

Dugwells in Panchmahals, 1976

Sr. No.	Name of the Taluka	Irrigation wells No.	Of Total Wells: Masonary No.	Of Total Wells: Non-masonary No.	Energised Area: Wells No.	Energised Area: Under irrigation (hectares)
1	2	3	4	5	6	7
1.	Godhra*	6520	2863	3657	411	2170
2.	Shehera*	2488	1043	1445	115	1032
3.	Lunawada*	2881	2022	859	285	1188
4.	Santrampur*	4667	2678	1989	56	1687
5.	Jhalod*	4666	240	4426	80	1806
6.	Dahod*	2228	1304	924	41	845
7.	Limkheda*	3673	3087	586	56	1191
8.	Devgadh Baria	3077	2450	627	422	798
9.	Kalol	1078	860	218	375	608
10.	Halol	1269	913	356	228	490
11.	Jambughoda	689	367	322	52	218
	District	33236	17827	15409	2121	12033

Note: * Drought Prone Talukas as declared by Government of India in 1973-74.

Source: Master Plan MI Division, Godhra, 1979.

* An enquiry into this revealed that they were all probable sites. Only a preliminary survey has been carried out. The geologists opine that tubewells are almost ruled out for district.

Table 5.9

Dugwells in Panchmahals : ~~1977-78~~ 1979-80

Sr. No.	Name of the taluka	Irrigation wells		Area in hectares	
		Masonary	Non-masonary	Total	Irrigated
1	2	3	4	5	6
1.	Godhra	2500	1986	4486	1908
2.	Shehera	1563	1055	2618	1928
3.	Lunawada	4794	927	5721	2284
4.	Santrampur	3647	4610	8257	966
5.	Jhalod	2062	3033	5095	3101
6.	Dahod	2209	857	3066	969
7.	Limkheda	2163	3672	5835	585
8.	Devgadh Baria	2672	1234	3906	1490
9.	Kalol	1527	-	1527	1527
10.	Halol	525	539	1064	1414
11.	Jambughoda	449	421	870	299
	District	24111	18334	42445	16471

Source: District Statistical - 1979-80.

Table-5.10

Dugwells in Panchmahals - ~~1979-80~~ 1977-78

Sr. No.	Name of the taluka	Irrigation wells	Wells with oil engines	Wells with electric pumps	Potential Command in Hectares
1	2	3	4	5	6
1.	Godhra	4250	500	613	3200
2.	Shehera	4934	476	171	3100
3.	Lunawada	5910	2340	544	5844
4.	Santrampur	7354	440	454	4550
5.	Jhalod	3430	820	306	2800
6.	Dahod	2212	169	43	1400
7.	Limkheda	4350	400	61	2650
8.	Devgadh Baria	6000	425	161	3625
9.	Kalol	1450	410	757	1850
10.	Halol	1360	615	259	1600
11.	Jambughoda	900	156	57	651
	Total	42150	6751	3426	31270

Source: District Statistical Abstract: 1975-76, 1976-77, 1977-78.

Of these three tables, table 5.8 is compiled from Master Plan MI Division and tables 5.9 and 5.10 have been compiled from District Statistical Abstracts. Some figures are striking. The latest district Statistical Abstract (1979-80) has published data as supplied finally by Agricultural Directorate. The earlier Abstract (1975-76 to 1977-78 Jointly published) publishes information supplied by the District Agriculture Officer. The total number of irrigation wells are more or less same but the area is significantly different. It is not clear about how the District Agriculture Officer could estimate the potential command of wells. The actual irrigated area as given by tables 5.8 and 5.9 are likely to be nearer to reality. The more serious question is : Is it likely that number of wells have gone up by about 9000 and the number of energised wells have gone up by about 8000? Table 5.8 when compared with Tables 5.9 and 5.10 gives such results. There must be some data problems. The later half of 1970s have witnessed a phenomenal rise in government expenditure on irrigated agriculture. Almost all the schemes and programmes like Drought Prone Area Programme, Tribal Area Sub-Plan, Integrated Rural Development Programme, Block Level Plans etc. have spent a lot of money on subsidising for wells and on energising the private wells. But the results are still astonishing. One should be cautious in drawing any conclusion from these tables derived from varied sources.

The most striking feature however is the capacity of the wells in the district. They irrigate hardly 0.38 to 0.4 hectare on an average per unit. This is inclusive of wells with energization. The author gathered an impression after interacting with large number of farmers that the yield from wells is generally low but varies from area to area. Broadly the southern talukas have an edge over rest of the district. In the drought prone talukas, the energised wells can operate for only two to three hours. After that the wells are to be allowed 24 hours so that they can recuperate.

The cost of digging wells is also high. One is usually confronted with hard rock after 3 or 4 feet of crest soil. The explosives too are not much of help. We should mention here that the big and medium irrigation schemes have been delayed due to long drawn procedure of rock cutting on the dam sites. With most of the easy places already exploited (Southern talukas), the district now faces hard rock area for digging wells. High subsidy rates (50% in case of a tribal former, otherwise a maximum of 33 $\frac{1}{3}$ % of the total cost) have enabled some fast work in this direction but one will have to wait and watch actual irrigated area in future.

5.1 Availability of Water.

We have seen by now that the government intervention has enabled exploitation of every kind of alternative sources of minor irrigation. One should however, look at the potential which exists in the area. The idea of local level planning in order to reduce the regional disparities derives its strength basically from the assumption that the relatively backward areas have lot of potential which needs to be exploited. The cost of exploitation, it is thought, will be little higher. We are so overwhelmed with idea of distribution that we tend to ignore the basic limitations which may confront the area concerned. We should, therefore, attempt first to get an idea about the availability of water in the district and then proceed further to explore the possibilities of viable exploitation.

Surface Water :

The entire district (except Jambughoda taluka) is under Mahi Basin. The Mahi River is perennial and passes through the district. All the other rivers and rivulets pay tribute to this River. The total of all these streams form the following water--sheds :

1. Mahi
2. Mahi Panam
3. Mahi Bhadar
4. Mahi Suki
5. Mahi Anas
6. Mahi Meshvi
7. Mahi Kun.

The other rivers which from sub-watersheds with the above rivers are: Chikhani, Khan, Kalutari, Ujal, Chibota, Machhan, Goma, Kharod, Vishwamitri, Kali, Karad, Kali (II), Hadaf, Khatlaer and Bandhara. It is difficult to give any estimate about the available surface water from these rivers. It may be obtained with enough technical expertise, but currently no such estimates are available. We shall show the attempts made to tape the water from these rivers by constructing dams.

Table-5.11

Rivers, Flows and Dams in Panchmahals

Sr. No.	Name of River/ Rivulet	Meets River Name	Ultimately Meets-Name	Dam if constructed name	Potential command in Hectare
1	2	3	4	5	6
I. Rivulets					
1.	Bandhara	-	Mahi	-	-
2.	Chibota	Khatlear	Mahi	-	-
3.	Chikhani	Kun	Mahi	-	-
4.	Goma*	-	-	Goma	NK
5.	Hadaf	Panam	Mahi	Hadaf	4656
6.	Kabutari	Hadaf	Mahi	Kabutari	1559
7.	Kali-1	Anas	Mahi	-	
8.	Kali-2	Anas	Mahi	Kali dam Tadbal Tank	
9.	Karad*	-	-	Karad	4480
10.	Khan	Anas	Mahi	Pata-dungri	4225
11.	Kharod	Khan	Mahi	-	-
12.	Khatlear	-	Mahi	-	-
13.	Machhan**	-	Mahi	MachhanNala	4076
14.	Ujal	Panam	Mahi	-	
15.	Vishwamitri*	-	-	-	-
II. Rivers					
1.	Anas	Mahi	Arabean Sea	-	
2.	Bhadar	Mahi	"	Bhadar	5705
3.	Kun	"	"	-	
4.	Mahi	-	"	Kadana	16,270
5.	Meshri	Mahi	"		
6.	Panam	"	"	Panam	45,490
7.	Suki	"	"	-	

* These rivulets enter Baroda District. ** Meets Mahi in Rajasthan.
Source: Compiled from : (1) Gazetteer of India, Gujarat State, Panchmahals district, 1970 (2) Master Plan MI Divn., Godhra, 1979.

Panchmahals district is on the whole an upstream area for the districts Kaira, Sabarkantha, and Baroda. The Arvaalli line of rock formation is extended upto Panchmahals. It can be observed from table 5.11 that there have been efforts to harness the surface water sources. Kadana Multipurpose project is a major dam but Panchmahals get water only through the Right Bank Canal. The Left Bank Canal goes to irrigate tens of thousand hectares in Kaira district. Anas river has now a lift irrigation scheme and Meshri river is tapped for drinking water for Godhra town which is the district headquarter.

Over and above the dams mentioned there are other medium irrigation schemes which are under survey and construction. They are : Umaria, Idalwada, Vankleshwar and Dev with potential command of 2378, 1360 and 2400 hectares respectively. The Dev dam will benefit Baroda district. By major and medium dams the district has a potential of 92599 hectares. The latest figure available for land utilization suggests that the area under cultivation in 1977-78 was 4,74,031 hectares. Once all these irrigation projects commission, the area covered by these projects will be around 19.5 per cent of the net-cropped area. The other surface sources are tanks. We have already seen that the Class I tanks in all will add another 34086 hectares. All the other minor sources harnessing surface water will add another 18996 hectars of irrigation potential. With the present master plan the district will be able to have (government claim) 1,41,049 hectares of area under irrigation. The share of minor sources turns out to be 38 per cent. This is without adding the lift irrigation through dugwells. The surface sources alone as per the government estimates have potential to irrigate 30% of the net cropped area.

We have already examined at length the overestimates in tank irrigation potential. One has to take these figures with caution. We shall discuss this again in viability issue.

The Ground Water Sources and Potential.

The Gujarat water Resource Development Corporation has recently conducted surveys and has published the reports. Table5.12 gives a very comprehensive picture of the groundwater situation in the district. With the help of this table we shall be in a position to say something about the water availability.

Item 28 of the table shows that the district is presently utilizing 25 per cent of the total groundwater potential that is available every year. This indicates at the potential that exists for exploitation. Every year there is a gross recharge of 1047.81 MCM (Million Cubic Meter) of which 733.47 MCM is recoverable recharge. The district is placed in a comfortable position.

Table-5.12

Hydrological Data of Panchmahals District: 1978-79

Sr. No.	Items	Shehera	Baria	Limkheda	Dohad	Jhalod	Santrampur	Lunawada	Halol	Kalol	Godhra	Jambughoda	Total 78-79	Total 81-82
		Name of Taluka												
1.	Total Geographical Area in Sq.kms.	579.8	1144.7	1063.6	874.7	798.2	1360.3	954.7	519.3	398.0	1019.2	146.03	8549.54	8849.53
2.	Alluvial Area in Sq.kms.	-	-	-	-	-	-	-	103.86	24.0	-	-	127.86	127.86
3.	Hard Rock Area in Sq.kms.	579.8	1144.7	1063.6	[illegible]	798.2	1360.3	940.7	415.44	374.0	1019.2	146.03	8721.67	8721.67
4.	Saline area in sq.kms.	-	-	-	-	-	-	-	-	-	-	-	-	-
5.	Net suitable area in sq.kms.	579.8	1144.7	1063.6	874.7	798.2	1360.3	845.[illegible]	519.3	398.0	1019.2	146.03	8849.53	8849.53
6.	Total area under surface irri.in sq.kms.	8.86	9.94	1.57	55.32	17.66	61.81	19.44	2.53	64.98	5.84	1.36	245.83	245.83
7.	Average Rainfall, in mm/year	565.2	1102.13	965.2	1163.52	[illegible]9.86	1074.42	955.2	1062.72	1097.3	1097.3	1303.26	-	-
8.	Recharge due to rainfall in mcm/year	55.95	126.16	102.66	101.75	83.00	145.15	91.28	63.76	45.61	111.83	19.03	947.25	947.25
9.	Recharge due to seepage from canal mcm/yr.	-	-	-	-	-	-	00.26	-	01.32	-	-	02.62	02.62
10.	Recharge due to return seepage from irrigation field in mcm/year	2.20	2.03	0.44	20.88	4.82	23.73	5.31	0.69	26.52	1.34	0.37	88.37	88.37
11.	Recharge due to return seepage from paddy field in mcm/year	-	-	-	-	-	-	-	-	-	-	-	-	-
12.	Recharge due to tank in mcm/year	00.84	00.66	00.44	1.03	0.91	1.23	1.74	0.74	0.63	1.24	0.11	9.57	9.57
13.	Gross Recharge in mcm/year	59.00	128.85	103.54	123.67	88.73	171.11	98.59	65.19	74.18	114.41	19.51	1047.81	1047.81
14.	Recoverable recharge in mcm/year	41.3	90.19	72.48	86.45	62.11	119.77	69.01	45.63	51.22	80.09	13.66	733.47	733.47
15.	Total No.of Dugwells.	3250	5192	4129	2356	5135	5831	3362	1079	6279	4921	1011	43465	44572
16.	Total No.of wells with pumpsets	556	437	177	185	297	690	2662	843	1257	946	392	8406	8616
17.	Total No.of Pvt. Tubewells	-	-	-	-	-	-	-	-	-	-	-	-	-
18.	Total No.of Govt.Tubewells	-	-	-	-	-	-		1	-	-	-	1	1
19.	TotalNo.of GWRDC Tubewells	-	-	-	-	-	-	-	-	-	-	-	-	-
20.	Draft due to Dugwells in mcm/year	12.03	18.91	15.28	8.72	9.00	25.27	12.44	3.99	23.23	16.21	3.74	160.89	164.92
21.	Draft due to pumpsets in mcm/year	6.60	5.24	1.76	2.22	3.56	8.28	31.94	10.98	15.71	11.35	4.70	102.34	104.9
22.	Draft due to Pvt. Tubewells in mcm/year	-	-	-	-	-	-	-	-	-	-	-	-	-
23.	Draft due to Govt.Tubewells in mcm/year	-	-	-	-	-	-	-	00.10	-	-	-	00.10	00.10
24.	Draft due to GWRDC Tubewells in mcm/year	-	-	-	-	-	-	-	-	-	-	-	-	-
25.	Total Draft in mcm/year	18.63	24.15	17.04	10.94	22.56	35.55	44.38	15.07	38.74	29.56	8.44	263.33	269.92
26.	Net Draft in mcm/year	13.04	16.90	11.93	7.66	15.79	23.48	31.07	10.54	27.25	20.69	5.90	184.33	188.94
27.	Potential Available in MCM/year	11.94	73.29	60.55	78.90	46.32	96.29	37.94	35.09	24.67	24.36	7.76	549.14	544.53
28.	EST Fractional Recharge Represented by Existing Draft in %	52.62	18.94	16.46	8.84	25.42	19.60	45.02	23.10	52.48	25.83	43.19	25.13	25.76

Source. Gujarat Water Resources Development of COR (Poration) Office of the Geologist, Groundwater Sub-Division No.12,Godhra.

A Crude estimate of total water availability :

We shall now proceed to get a crude estimate of the total water availability every year in the district. The ground water available for use is 733.47 MCM or 2591.77 Mc.ft. (2.83 MCM=10 Mcft) as suggested in item 14 of Table 5.11. If we add the storage capacity of major, medium and minor sources it works out to be around 24,300 Mcft. There will be in all a total of 26,892 Mcft.of water available every year after all the proposed works are completed.

The groundwater potential is relatively low compared with surface water storage which is planned to be created. The total available annual groundwater is around 10% of the total water quantity which will be harnessed. The lift irrigation with dug-wells may be more economical but will have ultimately limited supply. If no surface water storage is created the groundwater with optimum exploitation will be able to irrigate 44,064 hectares (assuming that 7 Mcft will irrigate 17 acres - based on actual area irrigated in 1977-78 Table 5.9 and item 20-21 of Table 5.12). This will imply that the total available annual ground water can irrigated at any point of time 10 per cent of the net cropped area (1977-78 level). A liberal and optimistic estimate is that by utilizing 100 per cent ground water potential and the surface potential the district may be able to bring about 35 to 40 of net cropped area under irrigation. If it is really so then there will be a revolution in district's agriculture. The current irrigation statistics suggests that the total area irrigated is around 6% of the net-cropped area. The question is will it be feasible and if it is, will it be viable? We shall examine these questions now.

5.12 Physical Constraints :

In the earlier section we have presented a crude estimate of total water that can be harnessed from surface and groundwater sources. Not all the quantity which has been estimated can be effectively used for irrigation purposes.

Let us reexamine the groundwater potential first. Table 5.12 suggests that estimated fractional recharge representd by the existing draft to the total recoverable recharge is 25 in percentage terms. This indicates that another 75% can be utilized if the sources are tapped. The district already has as per table 5.12 44,572 wells. Of these 8616 are energised. The annual draft in 1978-79 was 164.92 and 104.90 MCM respectively. The draft from energised wells being obviously superior. The average draft of energised well works out to be 0.043 Mcft. per annum. The average draft of non-energised well works out be 0.016 Mcft per annum. How much further progress is likely in this direction?

Sinking tubewells is ruled out mostly for the district. There will not be any major break through in tubewell irrigation in district. Dugwells with motive power are the only effective alternative left. Of the total area of 8849.53 sq.kms., 127.86 sq.kms. are categorised as alluvial. The digging of well is relatively easy, over here. The rest of the area is categorised as hard rock area (item 3, table 5.13). It is beyond our competency to comment on where and at what depth water can be struck. We therefore, remain content by stating that proposition of dugwells in general is costly and frustrating. Digging and negotiating rocks just below 5 feet of the soil crest compels the cultivator to broaden the diameter of the well. It has been and it will be a chance phenomena to have negotiable sub--soil and water on the same site. One can say that all the potential can not be tapped because of this.

Energised the non-energised wells may be considered an alternative, but the present experience suggests that barring a few areas (Kalol, Halol, Godhra, Lunawada, with Alluvial patches) the energised wells are generally operated only for 2 to 3 hours in every 24 hours. The water yield is not enough at the source for the engine to run continuously. This is definitely a constraint. The engines and pumps are neither divisible nor portable once they are installed. In such a situation a 5 HP pump or engine may also remain underutilized. It is for this reason perhaps, the cultivators have not been very enthusiastic about availing the subsidy and loan facilities. The lack of response is more pronounced in case of small and marginal farmers.*

It is one thing to observe that there is an unutilized potential and entirely another thing to suggest how it can be utilized. The feasibility of digging wells further in a big way needs a proper examination by competent authorities. Common sense logic tells us that if dugwells were so easily possible the cultivators would have given it a trial. The significant non-utilization goes also to indicate feasibility problems.

Surface Sources

We do not wish to comment on large and medium irrigation project since we are not currently connected with the viability issue of major works. The minor source alone if exploited (as per the Master Plan), are likely to create a capacity of about 53000 Mcft every year. Presently, about 20,000 Mcft of storage is obtainable in completed works. This figure is, however, given by the Master Plan and is an overestimate. We have already gone in detail to examine the reasons. We shall however, make two or three important points indicating at the constraints.

(1) The groundwater division research survey suggests that recharge due to tanks is not very impressive. The recharge due to tanks in years 1978-79 and 1981-82 has been 9.57 MCM or

*When the author had discussed with farmers in Abhod village of Dahod and Zinzni of Devgadh Baria, the small cultivators with wells had expressed fear that they would be indebted if they went for energization. They were found irrigating less than 1/2 acre in most cases near the wells.

34 Mcft (item 12, table 5.12). This includes all the type of tanks - first class, second class, percolation tanks, and village tanks. Even if we assume that this figure represents recharge from percolation tanks, it is on very low side. The Master Plan suggests that the storage capacity of completed percolation tanks is around 570 Mcft every year. One must be less optimistic now about the percolation tanks capacity to recharge.

(2) It is strange but true that dependability decreases with the decrase in annual average rainfall in the area. The Public Work Department itself has suggested that the dependability taken for different average annual rainfalls must be the following :

Table 5.13

Dependability Commensurate with Rainfall

Sr. No.	Average Annual Rainfall		Percentage dependability
1.	Less than 380 mm	(15")	40%
2.	380mm to 760 mm	(15" to 30")	50%
3.	760mm to 1520 mm	(30" to 60")	65%

Source: Manual on Percolation Tanks, PWD, Sachivalaya, Gandhinagar, Gujarat State, 1976.

For calculating the storage in reservoir actual rainfall in catchment is important. Lesser the rainfall lower is the dependability. There is an added dimension to this. If we refer back to discussion on the climate and rainfall of the district we find that low rainfall is associated with higher variation. Not only that the precipation is less the distribution is also more uneven. We have seen that in most of the tank cases a liberal attitude has been taken with regard to dependability. 75% dependability is, therefore, an overestimate. In arid and semi-arid regions therefore, dependability will be less and commensurate with actual average annual rainfall.

Thus, the constraints, which are significant, reduce the scope of surface irrigation from minor sources significantly. Wherever they are feasible the viability should also be examined.

5.13 Issues in Viability.

We have said that the Class 1 irrigation tanks in general are not a viable proposition from the society's point of view. We have also seen that second class irrigation is far inferior an alternative. It does not need any amplification. Similarly, the fate of porcolation tanks is almost sealed. Society should not possibly justify an investment of Rs.86.88 lakhs leading to an annual recharge of 34 Mcft of water. This would imply that society incurres a cost of Rs.37,128 per hectare (assuming that 34 Mcft irrigates 234 hectares annually-assumed duty of 7 hectares which is average well duty). The irrigation in 234 hectares will be possible only when wells are either dug or energised or both in the downstream. Even if they are already existing, the cost will be purely an additional one.

Check dams too entail a cost on the part of farmers. An average cost of Rs.10,000 per hectare will be an additional cost to the society. These are serious enough issues that have not been examined.

The only alternative apparently is the lift irrigation through dugwells. Assuming that with physical constraints dug-wells and energising dugwells are feasible, let us look into the economics of it. In 1978-79 there were 43,465 wells and had an annual draft of 160.89 MCM (through non-energised) and 102.34 MCM (through energised wells) (Refer Table 5.12), of water. The actual irrigation through wells in 1977-78 is reported to be 16,471 hectares. If we assume the same figure for 1978-79, 1 Mcft of water drawn through wells could irrigate 43 acres of land. This figure is very alarming, No doubt this shows that there is very economic use of water. If we compare the actual duty of tanks (class I) in table 5.9 it is 8. 1 Mcft of water drawn from well could irrigate 35 acres more than 1 Mcft of water flown through tank canals. The second revelation is that well owning farmers must be spreading the water too thinly. This is the classic case of extensive versus intensive irrigation. If the farmers in Panchmahals in general prefer spreading the water thinly there must be some reasons. Assuming rationality on the part of farmers one can argue that yield forgone due to less in intensity of irrigation must be compensated for by increase in total output on all plots.

There is also a further implication which is serious. The average area irrigated by a well works out to be 0.93 acres. This is very low. Assuming that energised wells irrigated significantly more on an average, the non-energised wells must be having an average command which must be very low. If this is accepted then the selecting this alternative as minor source of irrigation may be costly. The average cost of digging a well in a hard rock area should be higher than the digging a well in alluvial soil. With such a limited command a huge investment will be warranted. Even from the farmer's view point the investment other than government subsidy may prove to be uneconomic. He cannot cover even 1/2 acre or so intensively. If he provides a watering or two, the yield differential may be substantial in a bad year but not so in average rainfall years. This is a very broad picture and may not be true for all the areas. The author has visited farms in south of district Kalol taluka, for instance, where wells have both extensive and intensive irrigation. The abovementioned situation is likely to prevail in drought prone talukas where a plea for tank irrigation is generally made. In short it appears that scope of developing minor sources of irrigation in the district in general is rather bleak. More so if it has to be developed considering the economic viability even from the social view point. The urgency for improving the socio-economic status of the semi-arid and arid area population may be acute but it appears that minor irrigation would hardly offer a break-through. One must therefore start exploring other possibilities.