

Diagnosis of Process and Performance of Irrigation Management Transfer in Panchkanya Irrigation System

(Process Documentation Report No. 7)

A Collaborative Research Program of:

**Institute of Agriculture and Animal Science
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and
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Water Management Study Program (WMSP) is an institutional program of the Institute of Agriculture and Animal Science (IAAS), Tribhuvan university with the mission to address the issues on water management and other areas of natural resources through research, publication, training and interdisciplinary discussion and knowledge sharing among intellectual/scientific community, policy personnel and users.

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1.1 About this Report

This report is an output of a Process Documentation Research (PDR) effort in three irrigation schemes- Nepal West Gandak Irrigation System in Nawalparasi District, and Khageri and Panchakanya Irrigation Schemes in Chitwan District, that were candidate irrigation systems for management transfer in the Phase-I program under Irrigation Management Transfer Project (IMTP). This report includes process and performance of irrigation management transfer in Panchakanya Irrigation System. Similar report is being worked out for Khageri Irrigation System. The ultimate aim of this PDR effort is to draw a comparison of the process and performance of irrigation management transfer in the three irrigation system.

The PDR in the three irrigation systems is being conducted as a collaborative research program of Water Management Study Program (WMSP) at the Institute of Agriculture and Animal Science (IAAS), International Water Management Institute (IWMI) and Research and Technology Development Branch (RTDB) of Department of Irrigation. The study is being supported under a research grant of the Ford Foundation, New Delhi made available to WMSP/IAAS and a supplemental grant of RTDB/IWMI. The funding institutions are gratefully acknowledged by WMSP/IAAS.

1.2 Location of Panchakanya Irrigation System

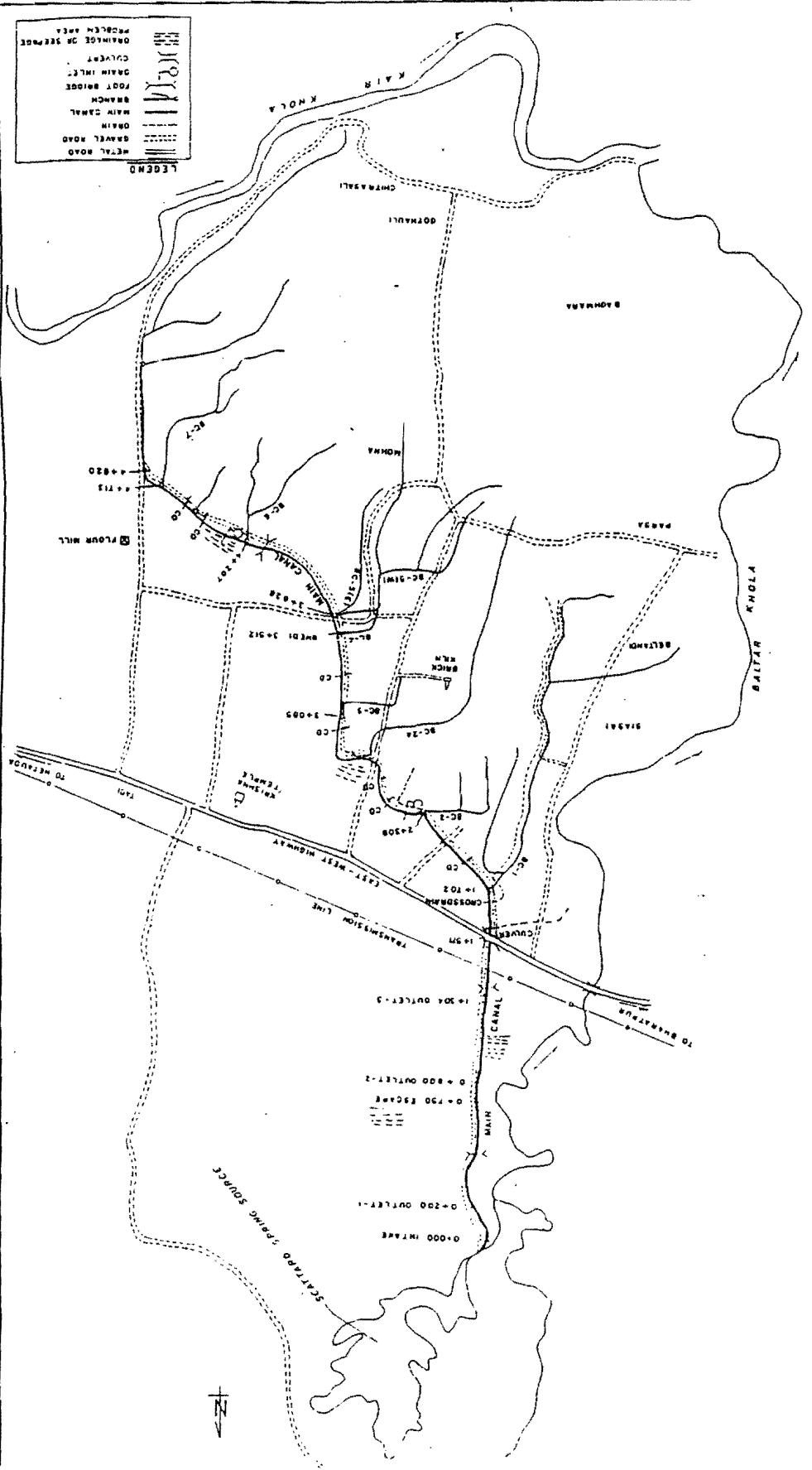
Panchakanya Irrigation System (PIS) is a small gravity flow irrigation scheme located in the central part of the Chitwan District. The source of the system is *Panchanadi*, a tributary of Khageri river, which in fact is a perennial drain formed with the confluence of five perennial springs in the catchment. The intake and the service area of the scheme is located in Ward Nos.1,4,5,6,7,8 and 9 of the Ratnanagar Municipality¹ that includes 17 settlements- *Gheghauli, Bhojad, Dhekuwa, Sisai, Tikauli, Nipani, Bhedi, Gadauli, Dhusari Birta, Mohana, Debauli, Gothauli, Baghmara, Bargaon, Hardi, Narkatia and Nayaparsa*, under the command (Fig.1).

Bharatpur-Hetaunda section of East-West Highway (*Mahendra Rajmarga*) passes through the head reach of the system, that crosses the main canal at Krishna Mandir², about 8 km east of Bharatpur, the headquarter of Chitwan District. A number of earthen and graveled link roads connect all the settlements within the service area with the highway, therefore all parts of the service area are easily accessible on vehicle.

1.3 Physiography, Soils and Climate of Chitwan District vis-à-vis PIS

More than three-fourths of the area of Chitwan District falls within Chitwan valley³, located between *Mahabharat* range of hills in the North and *Chauria* hills in the south. The valley plains are almost flat formed by detrital deposition from the lower slopes of enclosing *Mahabharat* and *Chauria* Hills. The principle feature of Chitwan valley is

LEGEND	
	METAL ROAD
	CANAL
	BRANCH
	FOOT BRIDGE
	DRAIN INLET
	CULVERT
	DRAINAGE OR SEWERAGE
	RESERVE AREA



alluvial plains dissected into a mosaic of land types by the action of tributaries of Narayani and Rapti rivers which are two major drainage systems of the valley.

Chitwan valley is divided into Eastern and Western parts by Khageri river- the area to the east of Khageri is popularly known as Eastern Chitwan, and that to the west is known as Western Chitwan. The area south of the Rapti River is called *Madi* valley (Fig.2). Eastern Chitwan is relatively rich in water resources in comparison with Western Chitwan and *Madi* valley. Many perennial and seasonal streams flow through Eastern Chitwan that include- *Khageri* river, *Kair Khola*, *Pampa Khola*, *Martal Khola*, *Budhi Rapti*, *Chatra Khola* and *Dhungre Khola*, flowing north-south or east-west direction. Several farmer managed irrigation systems (FMISs) exit in this part of the District with supply derived from these streams. Shukla et.al. (1993) have documented characteristics and performance of over 88 FMISs in eastern Chitwan.

The soils of most parts of the Chitwan valley are relatively young without much differentiation into horizons. Sandy loam and loam are the most dominant textural classes of the surface soils with few patches of sandy clay loam and silty clay loam. The soils of Eastern Chitwan, in general, are heavier in texture than those in the western Chitwan. Relatively high content of organic matter (average 2.8 percent) of Chitwan soils reflect recent agricultural history. The soils in general have been reported to be with adequate amount of Nitrogen and Phosphorous and high in Potash, however deficient in Zinc and Boron (Joshi, 1981; Khatri-Chhetri, 1982). The soils of most uplands and well drained low lands are acidic in reaction (pH 4.2-7.0) where as in the depressed areas and low land paddy fields, where drainage is impeded, the soils have alkaline (pH 7.0-8.5) reaction (Khatri-Chhetri, 1982). Physical and chemical properties of soil at two reaches of Panchakanya Irrigation System, reported in a more recent investigation is illustrated in Box-1.

The climate of Chitwan valley is sub-tropical monsoon type with hot and humid summer and cool dry winter. The climatic summary at Rampur which is representative for most part of the district is presented in Box-2. In general there is plenty of sunshine for most parts of the year. The hottest months are April, May and June when the average maximum temperature rises up to 35°C with extremes as high as 38°C. The months from June to September are hot, humid and uncomfortable. November through February are the winter months with average winter season temperature as low as 7°C during December and January. Over 75% of annual rainfall occurs during June through September with mean annual rainfall being 2000 mm. Occurrence of rainfall in other months is erratic both spatially and temporally. Heavy dew deposition during the winter month is typical of the valley.

The agroclimatic condition of Chitwan valley is favorable for tropical and subtropical crops, fruits and vegetables. The major crops grown in the valley are rice, maize, mustard, wheat and pulses. The credit for agricultural development in the valley goes to the new settlers who were more innovative in adoption of new agricultural technology. As a result intensive agriculture including crop cultivation and livestock raising is practiced in the valley. Chitwan District over time has become one of the most potential area for surplus food production, oil seeds, fruits, vegetables and animal products in the country.

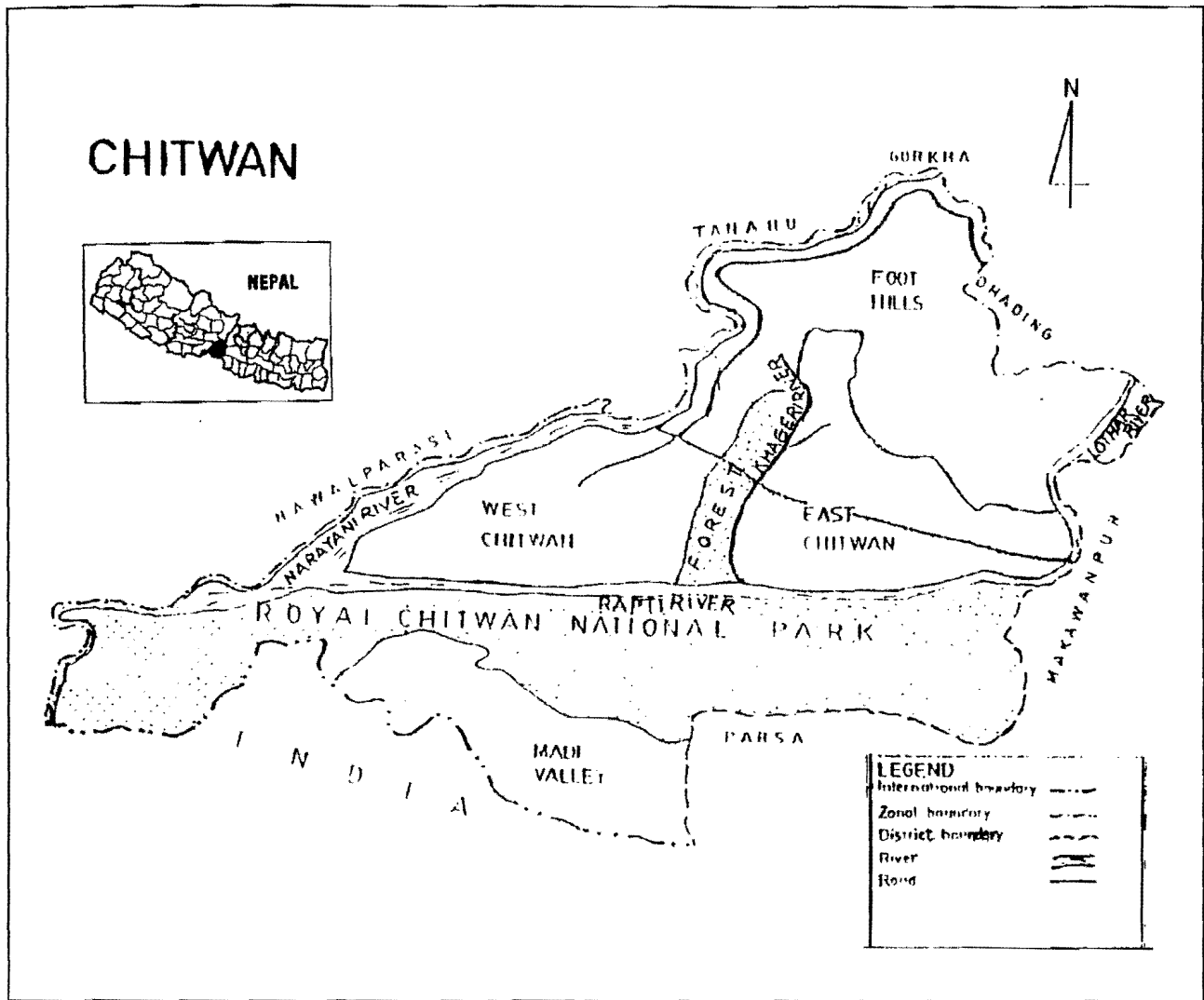


Fig.2. Chitwan District

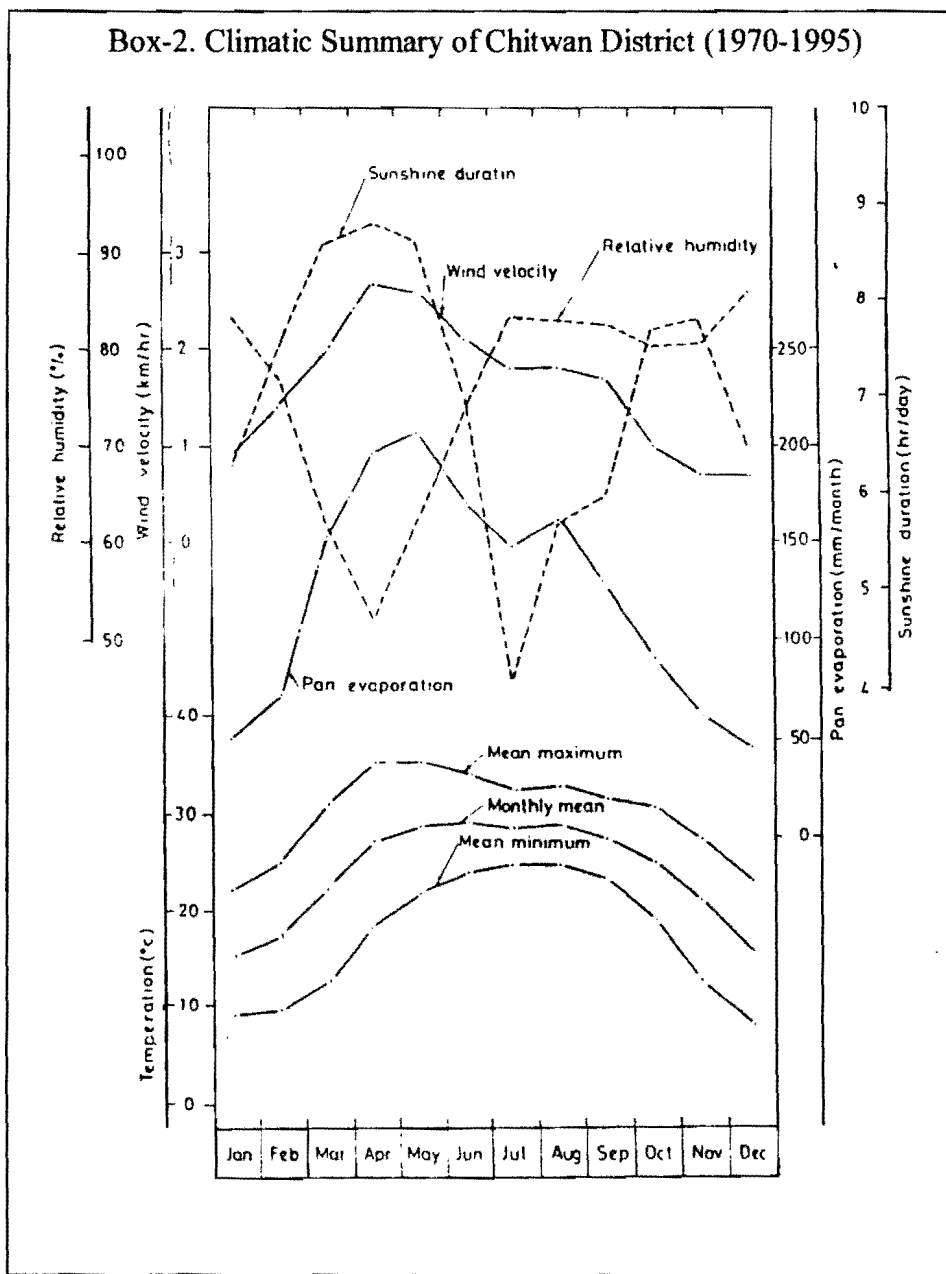
Box-1 Chemical Analysis of Soils in Panchakanya

Soil Attribute	Location ¹	
	Head	Tail
pH	5.90	6.20
Total N (%)	0.06	0.12
Available P (mg/kg)	2.00	6.00
Available K (mg/kg)	55.00	50.00

Source: RTDB/IMD/DOI, 1995

¹ Branch Canal No. 1 and 6 in the source information have been called Head and Tail, respectively.

Box-2. Climatic Summary of Chitwan District (1970-1995)



1.4 Historical Accounts of Development of Panchakanya Irrigation System

Chitwan valley is one of the recently settled areas of the country. Owing to Malaria epidemic, this valley was under dense forest and was left uncultivated for a long time. Before being opened for planned settlement, there were *Tharus* and *Darais*- the original inhabitants, whose settlements were scattered. The valley then was known as "Malariahell" (Elder et.al. 1976).

Planned settlement in the valley began in 1951 under Rapti Valley Development Project. In 1953, flood and landslide washed hundreds of villages in the Central Hills. Beginning the same year the Rapti Valley Development Project started malaria eradication program. Since one of the goals of the project was to convert forest into farmlands, the government decided to encourage the flood victims to settle in the valley and to clear and cultivate lands, of which they eventually became the owner (Elder et.al. 1976). During 1958-59 people from all parts of the country came to settle in the valley under the resettlement program. The major influx of migrants into the valley was from adjoining Lamjung, Tanahun, Gorkha, Baglung, Parbat, Dhading and Nuwakot Districts. There has been unprecedented increase in the population of the Chitwan District since 1961 that nearly doubled in 1991 (Box-3).

Year	Population (in millions)	
	Nepal	Chitwan District
1961	9.40	0.069
1971	11.50	0.184
1981	15.50	0.259
1991	18.50	0.355

Source: CBS, 1993

Agriculture in the valley prior to 1950s was limited around the scattered settlements of *Tharus* and *Darais*. The livelihood of the *Tharus* and *Darais* was based on rice growing, therefore they had built irrigation canals as a means of security against rainfall failure to support rice production during monsoon. The *Tharus*, like elsewhere in the country, are pioneers of irrigation development in Chitwan valley.

Panchakanya Irrigation System is believed to have been developed by then *Tharu* landlord of *Sisai* and *Bhojad mauja* (villages) more than 200 years ago⁴. The canal that time was earthen, that followed almost the same alignment as today's main canal, with temporary diversion structures built every year at about 100 meters downstream of the today's intake. The system then was supporting irrigation needs of almost 150 bighas (100ha) of land during monsoon in these two villages. Other *maujas* of today's command area, which were also inhabited by *Tharus*, were- *Debauli*, *Gothauli*, *Baghmara*, *Mohana*, *Bhedi*, *Gadauli* and *Nipani*. These villages had access to another irrigation canal, called *Budhi Kulo*⁵ that had intake in *Kair Khola*. This supports the claims of the people in the area that much of the today's command area of the system was under cultivation prior to the initiation of settlement of the migrants in 1951, when most of other areas of Chitwan were still under forest. Settlement of the migrants in the command

area of the system began as early as in 1952. An approximation of population composition in 1970 (2025/026 B.S.) and 1999 (2055/056 B.S.) made by some key informants indicate that the total population of the command area included 95% *Tharus* and 5% migrants in 1970 that was changed to 75% migrants and 25% *Tharus* in 1999.

In a major flood in *Kair Khola* in 1967 (2023 B.S.), *Budhi Kulo* that supported irrigation in almost 7 *maujas* was destroyed. In fact a channel of *Kair River* entered through *Budhi Kulo* during the flood that caused severe damages to arable lands in the area, rendering *Budhi Kulo* useless for subsequent irrigation. Since there was ample supply at the source in *Panchakanya Kulo*, the users of the 7 *maujas* served by *Budhi Kulo* approached the *Panchakanya* users for access to irrigation. A proposal came from the users of these *maujas* in 1968 (2024 B.S.) to dig another canal intake at about 150 meters upstream of the today's intake of *Panchakanya*. This effort could not succeed because the users of then *Panchakanya Kulo* from *Sisai* and *Bhojad mauja* resisted the new canal construction due to their prior rights to water at the source.

During 1961-62 (2017 B.S.), construction of *Khageri Irrigation System* began with intake in *Khageri River* at *Tikauli* about 2 km downstream of the existing intake of *Panchakanya*. The aim of the scheme was to bring about 4000 ha of land under irrigation during monsoon in the western part of *Chitwan District*. The construction works were completed and the system became operational in 1968-69 (2024 B.S.).

Panchakanya Irrigation System continued to remain farmer managed system of *Sisai* and *Bhojad* villages until 1974. In 1974 the system was adopted under *Chitwan Irrigation Development Project (CIDP)*⁶ for rehabilitation and improvement. The construction works were started in March 1997 that included a gated concrete headwork at the source, construction of 5 km of earthen main canal, about 5.5 km of drainage works, 7 number of gated outlets for the branch canals (branch canals were not constructed in this phase of development), 8 number of gated outlets at several locations to distribute water from the main canal. The aim of this development was to bring 600 ha of land under irrigation. The construction works were completed in June 1979 with total investment of NRs. 36 Lakhs, however only about 200 ha could be irrigated during 1979 - 1981 due to heavy seepage loss from the main canal and lack of branch and tertiary level facilities for water distribution.

Second phase of construction works under *CIDP* for rehabilitation and improvement were taken-up under *CIDP* in 1982-83 with total investment of 27 Lakhs that included-boulder lining in the main canal, construction of branch canals and outlets and construction of an intake in *Battar Khola* to augment dry season supply at *Panchanadi* headwork through approximately 450 m long underground humepipe waterway.⁷ With these improvements it was possible to expand the area under irrigation to about 400 ha. However, irrigation to this expanded area was possible only for few years. Since major parts of the main canal was constructed in filling, it began to collapse and the lining started getting damaged within few years after improvement. Beginning 1989-90 it became impossible to provide irrigation to even 100 ha of land during monsoon. The situation of *Panchakanya* continued to remain so until participatory process in irrigation management and rehabilitation and improvement of the essential structures was initiated in 1995 under *Irrigation Management Transfer Project (IMTP)*.⁸

1.5 State of Canals and Physical Structures in PIS

Much of the canal system and structures that are seen today in Panchakanya Irrigation System were developed during second phase of rehabilitation and improvement under NIDP in 1982-85. The network of canals in conveyance and distribution system is illustrated in Fig. 2. The headwork in *Panchanadi* is overflow weir type with front intake made of concrete and brick/stone masonry. The main canal is 4.92 m long with north to south and east alignment. A 390-meter section of the main canal is covered while the rest of the canal is open and lined. There are all together 8 branch canals and 10 outlet canals in the canal network. Of the 8 branch canals in the system branch canal no. 8 was made operational in April, 19989 after system rehabilitation under IMTP. The details of different levels of canal in the system is presented in Table-1.1 and Fig.3, respectively.

The branch canals are much shorter in length and are mostly unlined. Of the eight branch canals in the system only Branch No. 1 is fully lined and Branch No. 4, 5 and 6 are partially lined while the rest of the branch canals are unlined. Water is delivered to the farmers' fields through network of tertiary and watercourses. In the absence of adequate development of tertiary canals and watercourses farmers practice field to field irrigation that renders them into uncertainty on timing and amount of water availability. The outlets have also connection with small secondary and tertiary level canals and watercourses with area under command of each outlet ranging from 2 to 10 ha.

Other structures in the canal system include division structures, escape, cross drain and culverts. There are also few drop structures in the main canal. Drainage is not a serious problem in most parts of the command area except at head reach of the system.

Photographs of canal system and physical structures annexed at the end of this Chapter (pages 15-19) provide glimpses of the physical characteristics of the system.

1.6 Characteristics and Performance of PIS Prior to IMTP

1.6.1 State and Performance of Physical Structures

Prior to Comprehensive rehabilitation and improvement under IMTP, the canals and physical structures were in a poor state and performance. The headwork was leaking from the gate and the sidewalls and the launching apron was damaged. The upstream reservoir at the headwork was heavily silted. Though the main canal was lined with stone/concrete blocks during second phase of rehabilitation and improvement under CIDP, in most portions the lining had fallen apart. As a result of this, losses in the system were tremendously high resulting to smaller irrigation coverage even during monsoon. The area under irrigation during monsoon assessed in 1994/95 in the constituent branch canals and outlets is given in Table-1.2, which totals the area under irrigation to be 272.10 ha as against planned area of 600 ha in the system. An assessment of irrigation adequacy and timeliness assessed by the users of the system at the time of adoption under IMTP is also illustrated in Table-1.2 which also indicates progressively increasing constrains on timeliness and adequacy from head to tail reaches of the system. The users reported that water would hardly reach upto outlet No. 7 and that Branch Canal No. 6 and 7 were not getting any irrigation supply.

Table-1.1 Hierarchy of Canals in the Conveyance Network of Panchakanya Irrigation System

S.N.	Name of the Canal	Chainage (m)	Length (m)	Tertiary Canals		Water Courses		Total Length of Canals (m)
				No	Legth (m)	No	Legth (m)	
1	Outlet No.1	203	292	??	167	??	119	
2	Outlet No.2	1016	199	??	119	??	??	
3	Outlet No.3	1489	5	2	81	5	1304	
4	Outlet No.4	1707	600	4	206	4	277	
5	Outlet No.5	1819	30	??	193	??	??	
6	Branch No.1	1884	1359	5	1255	14	2700	
7	Branch No.2	2390	645	3	346	4	1733	
8	Outlet No.6	2697	6	2	302	-	-	
9	Branch No.3	??	1101	2	1429	5	745	
10	Outlet No.4	??	112	3	735	4	664	
11	Outlet No.7	??	130	2	325	-	-	
12	Branch No.5	??	1126	6	1644	6	1965	
13	Outlet No.8	??	100	-	-	-	-	
14	Branch No.6	??	1180	6	2075	1	303	
15	Outlet No. 9	??	658	-	-	-	-	
16	Outlet No. 10	??	136	1	150	-	-	
17	Branch No.7	??	827	2	541	1	120	
18	Branch No.8	??	??	??	??	??	??	

Source: Canal Operation Plan (Main Canal) of Panchakanya Irrigation System

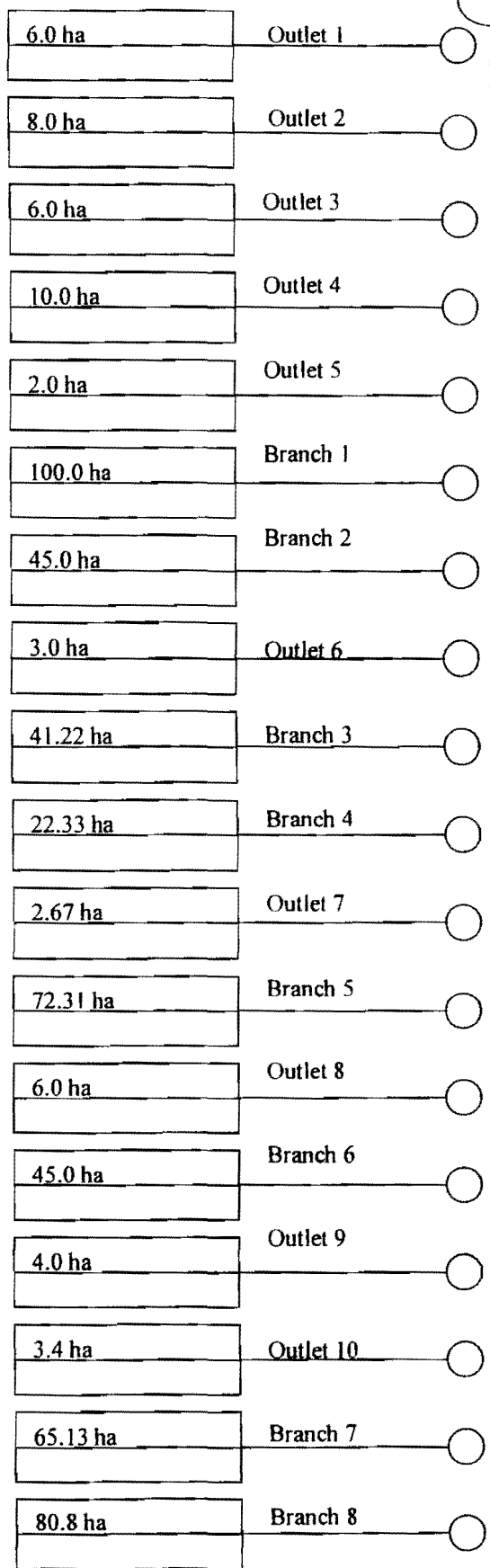


Fig. 3

Source: Neupane (Undated)

1.6.2 State and Performance of Irrigation Organization

An informal organization of water users had evolved immediately after the completion of second phase of rehabilitation and improvement under CIDP in 1985/86. An eleven member executive body of water users association had been formed in 1985/86 (2042 B.S.) and was involved mobilization for emergency repair and maintenance and establishing coordination with NLIP Office until initiation of joint management program in 1992. The then association of water users did not have written constitution and rules and regulations for operation and maintenance. The functionaries of the executive committee used to be selected on an ad-hoc basis and the tenure was not fixed.

Table-1.2. Assessment of Area under Irrigation and Water Adequacy by Branch canals and Outlets Prior to IMTP.

S.No.	Branch/Outlet No.	No. of Water Users	Area Under Irrigation(ha)	State of Adequacy and Timeliness ¹
1.	Outlet No. 1	16	5.33	High
2.	Outlet No. 2	13	5.82	
3.	Outlet No. 3	12	6.28	
4.	Outlet No. 4	21	10.65	Medium
5.	Outlet No. 5	3	2.50	
6.	Branch No. 1	103	62.71	Low
7.	Branch No. 2	45	26.52	
8.	Outlet No. 6	14	2.33	
9.	Outlet No. 7	39	31.92	
10.	Branch No. 3	30	11.61	No Irrigation
11.	Branch No. 4 + Outlet No. 8	44	20.90	
12.	Branch No. 5	26	10.88	
13.	Branch No. 6	70	29.87	No Irrigation
14.	Branch No. 7	72	44.76	

Source: WUA Records. These records were prepared by the officials of NLIP Office at the time of first election of WUA. The records were submitted to elected body of WUA on May 13, 1994 (2051/01/30 B.S.)

¹ Based on users assessment.

The PDR team of WMSP/IAAS could get access to review of minutes of meeting of the executive committee for 1991-1992 (Asar 2048-Poush 2050 B.S.). A list of functionaries and representatives in the executive committee during this period is shown in Box-4. Frequency of meeting and the nature of decision making of the then executive committee for the above stated period is summarized later in this report. Based on the information provided by the users and the review of the minutes of the meeting following assessment may be made about the state and performance of the organization of water users in PIS:

- The executive committee was constituted without much participation of the users in the process of election/selection of functionaries. It was a kind of picking few individuals from different parts of the system to represent in the executive committee. The tenure, duties and responsibilities was undefined. Almost same set of the people who were elected/selected to represent in the executive committee in 1985-86 continued to remain in the committee until the initiation of joint participatory management process and formation of formal WUA.
- Much of the decision making of the committee was limited to development of schedule of water allocation among different branch canals of the system during monsoon. From the minutes of meeting it also appears that the committee would change the allocation schedule several times during the crop season depending upon the available water supply in the canal and irrigation demand in the system.
- Though, the then committee was not registered as statutory body of water users, it appears from the minutes of meeting that CIDP office had recognized the committee as representative Organization of water users. The officials of CIDP used to participate in the meeting of the executive committee and the executive committee had established coordination with CIDP office in terms of making demands for repair and maintenance, mobilization of personnel (dhalpas and seasonal labors) for canal operation.
- There had been very little resource mobilization from among the users for operation and maintenance of the system, except some labor mobilization at the time of emergency repair. The operation and maintenance expenses prior to initiation of joint participatory management was solely funded by CIDP office.

Box-4. Functionaries of Informal Executive Body of WUA in PIS prior to IMTP

Chairperson	Mr. Chhanda Prasad Adhikari	Branch No.1, Bhojad
Vice-Chairperson	Mr. Ishwari Regmi	Branch No. 5, Mohana
Secretary	Mr. Chakrapani Adhikari	Branch No. 1, Dhekuwa
Member	Mr. Nem Raj Paudel	Branch No. 1, Dhekuwa
Member	Mr. Chinta Mani Acharya	Outlet No. 4, Dhekuwa
Member	Mr. Jaleshwor Mahato	Branch No. 1, Beltandi
Member	Mr. Lila Nath Mainali	Branch No. 5, Gadauli
Member	Mr. Setu Lama	Branch No. 4, Bhedi
Member	Mr. Raj Sharan Neupane	Branch No. 5, Mohana
Member	Mr. Chet Nath Paudel	Branch No. 6, Talgaun
Member	Mr. Madari Mahato	Outlet No. 9, Debauli

Source: WUA Records

1.6.3 State and Performance of Agricultural System

Cropping pattern in PIS continues to remain rice based with paddy, maize, wheat, mustard and pulses as dominant food crops. Where dependable irrigation supply was available during spring, the farmers used to grow spring paddy even before rehabilitation and improvement under IMTP. However, the area under spring paddy was much smaller and limited to head reach of the system. In the monsoon, major portion of area used to be under monsoon paddy however some of the farmers were also growing monsoon maize particularly in the uplands. Maize, mustard and wheat were the food crops grown in the winter. Major portion of the command area, except those upstream of the highway and in Branch No. 1, used to remain fallow during spring though some farmers were also growing spring maize but in a much smaller area.

An assessment of area under irrigation, cropping intensity, crop productivity and gross return of major crops in the three branch canals in PIS prior to IMTP, is illustrated in Table-1.3. The three branch canals in the assessment may be considered representative of the three reaches in the system: Branch No. 1-Head; Branch No. 4 -Middle and Branch No. 6 - Tail.

Table 15: Assessment of System and Agricultural Environment

Particulars	Branch No. 1 (Head)	Branch No. 4 (Middle)	Branch No. 6 (Tail)
Design Area	27 (100)	18 (100)	40 (100)
Area under Irrigation (ha)			
Monsoon	??	??	??
Winter	??	??	??
Spring	??	??	??
Cropping Pattern (Area under crops, ha)			
Monsoon			
Paddy	27(100)	18(100)	40(100)
Winter			
Wheat	2(7.41)	4(22.22)	7(17.50)
Pulses	4(14.81)	3(16.66)	6(15.00)
Oilseed	1(3.70)	6(33.33)	7(17.50)
Maize	3(11.11)	4(22.22)	11(27.50)
Spring			
Paddy	12(44.44)	0(0)	0(0)
Maize	13(48.15)	12(66.66)	32(80.00)
Cropping Intensity (%)	229.62	261.10	257.50
Crop Yield (kg/ha)			
Monsoon Paddy	2550	2836	3443
Spring Paddy	2753	NA	NA
Maize	1050	1088	1191
Pulse	540	597	642
Oilseed	-	746	634
Wheat	-	-	1851
Gross Margin by Crops			
Monsoon Paddy:			
Product Cost (NRs./ha)	11309	13074	14179
Revenue (NRs./ha)	21425	22851	27103
Gross Margin (NRs./ha)	10116	9777	12924
Spring Paddy:			
Product Cost (NRs./ha)	12011	NA	NA
Revenue (NRs./ha)	20771	NA	NA
Gross Margin (NRs./ha)	8760	NA	NA
Maize:			
Product Cost (NRs./ha)	5737	6252	6532
Revenue (NRs./ha)	8400	8703	8335
Gross Margin (NRs./ha)	2663	2451	1803
Pulses:			
Product Cost (NRs./ha)	1412	1412	1817
Revenue (NRs./ha)	4590	5075	7701
Gross Margin (NRs./ha)	3178	3663	5884
Oilseed:			
Product Cost (NRs./ha)	NA	5987	5907
Revenue (NRs./ha)	NA	11194	9513
Gross Margin (NRs./ha)	NA	5207	3606
Wheat:			
Product Cost (NRs./ha)	NA	NA	10012
Revenue (NRs./ha)	NA	NA	14955
Gross Margin (NRs./ha)	NA	NA	4943

Source: IMD/RTDB/DOI, 1995

Notes

1. Ratnanagar municipality was created by a cabinet decision in 1997/98 by combining the areas of Panchkanya and Ratnanagar Village Development Committees. Before the formation of Ratnanagar Municipality, the command area of PIS extended in Panchkanya VDC Ward Nos. 6 and 8 and in Ratnanagar VDC ward Nos. 6,7, and 8.
2. Krishna Mandir is located along narayangadh-Hetauda section of East-West highway, about 8km east of Bharatpur and about 1km east of barrage of Khageri Irrigation System at Tikauli.
3. Chitwan Valley is also called Rapti Doon and is extended in most larger area than the area of Chitwan District.
4. The estimate of two hundred years of age of PIS has been done because this system was developed by a Tharu landlord of Bhojad Village three generations ago.
5. Budhi Kulo after the flood of 1967 has developed into a stream. A canal of Kair Khola flows through Budhi Kulo today and supplies irrigation water to six farmer managed irrigation systems on the downstream.
6. Chitwan Irrigation Development Project (CIDP) under Chitwan Vally Development Project was originally conceived as Irrigated Agricultural Development Project. Narayani Lift Irrigation Project (NLIP) was developed under CIDP.
7. The Battar Khola intake is no longer in use in PIS.
8. Irrigation Management Transfer Project (IMTP) is a ADB funded irrigation development project conceived in July 1996. The project aims to institutionalize management transfer within DOI.



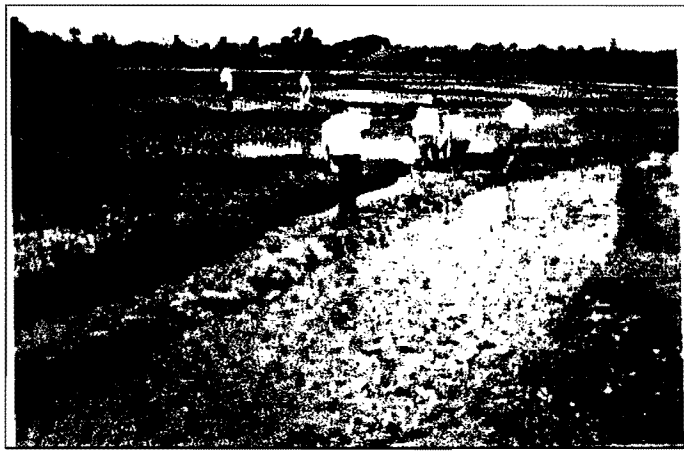
The catchment of *Panchanadi*. Its a physiographically depressed area surrounded by uplands. Water yield from this catchment is the source of supply of *Panchanadi*.



The catchment drains surface and sub-surface run-off from the upland that develops into channelized flow in five perennial drains. See women washing clothes at the head of one of such channel.



Channelized flow in one of the perennial drain



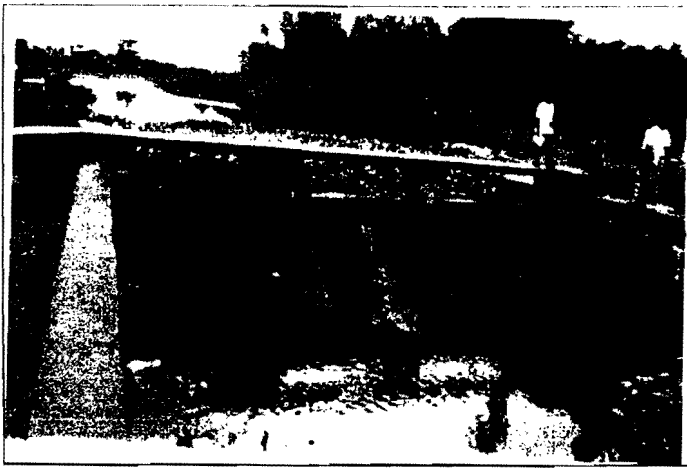
Channelized flow in another perennial drain. The volume of flow increases from upstream to downstream.



Panchanadi that develops with the confluence five perennial drains. *Panchanadi* also drains surface run-off.



Increasing encroachment in the catchment, expansion in the area under cultivation and depleting vegetation cover in the surrounding catchment are few of the several causes of changes in the hydrology and water yield of the catchment. Upland farmers who also own land in the lowland also pump water from the lowland



Headwork with front intake in *Panchanadi*.



Head regulator and escape at *Panchanadi* headwork. The volume of flow in the main canal during monsoon is higher than that in the dry season.



Battar Khola intake that was developed to augment dry season supply at the headwork of the *Panchanadi* during 1982-83. The water from this intake was carried through underground home-pipes to *Panchanadi*. This intake is no longer in use.



The main canal. Lined with cement-concrete during IMTP rehabilitation and improvement. The boulder lining were put during second phase of rehabilitation and improvement under NIDP.



A 390 m section of the main canal in the head reach has underground construction.



The main canal crosses the Bharatpur-Hetaunda a section of east-west highway at this point. This place is called *Krishna Mandir* about 1 km east of the intake of the Khageri Irrigation System.

Tail reach of the system. Branch No. 8 that was developed and made functional only after 1997.



The branch canals off-taking from the main canal are gated.



A section of main canal in the central region of command area. The outlets are ungated hump-pipes off-taking from the main canal. (Obstruction put in the main canal to maintain head in the outlets.



2. Process of Participatory Irrigation Management Transfer in Panchakanya Irrigation System

2.1 General

Irrigation management transfer program originate from the current policy of the government that aims to transfer, in part or in whole, the use right, operation and maintenance and primary management tasks of DOI managed irrigation schemes to legally recognized organizations of water users. Upon selection of an irrigation scheme for management transfer, the DOI concentrates on capacity building of water users and create an environment that could lead to progressively decreasing roles of DOI and increasing roles of water users in the operation and management of the system until complete management transfer occurs. After the management transfer the role of DOI limits to monitoring, evaluation, providing technical assistance and assistance in the events of system failure beyond the technical and financial capacity of the users. The process of management transfer in Panchakanya began in 1993 under USAID assisted Irrigation Management Project (IMP) that was further extended under Irrigation Management Transfer Project (IMTP). The system was turned-over to WUA in a formal ceremony on December 13, 1997 in the presence of the Director General of DOI.

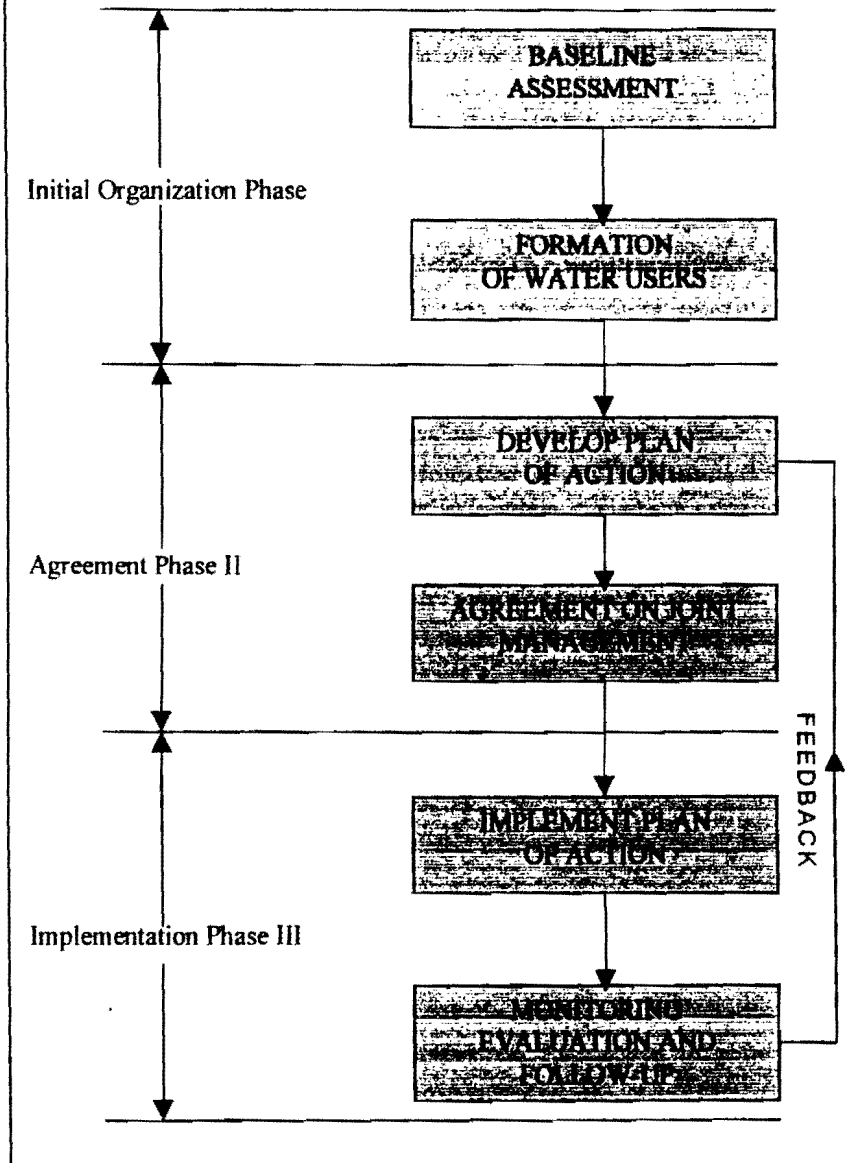
The framework of management transfer process adopted by DOI is illustrated in Box-5. The process has been designed to begin with the formation of users' organization wherein the users are to be organized in a multi-tiered water users' association (WUA) consistent with the structural complexity of the system. This process is to be started with an introductory workshop to explain the users and discuss with them the objectives and process of management transfer. Personnel from DOI are expected to identify and train local farmers to become farmer organizers (FOs). The DOI personnel together with FOs are then expected to generate relevant information to decide upon the organization of WUA of best fit to the socio-technical complexity of the system. The formation of WUA is to be initiated based on hydraulic boundary of the system beginning with the block and tertiary level to the main system level.

Side by side of formation of WUA and election of functionaries at different levels is to be completed and the constitution of WUA is to be drafted. The WUA is then to be registered to obtain the status of a statutory body. This then becomes the starting point for further processes of institutional development.

The second phase of activities include joint agreement between WUA and DOI stating the roles and responsibilities of each party. At this stage, the DOI personnel together with WUA are expected to identify operation and maintenance options that would eventually lead to the development of operation and maintenance plans. A classification of operation and maintenance plans into short term, medium term and long term, would help defining the gradual process of management transfer to WUA. A memorandum of agreement is to be developed between WUA and DOI to this effect.

The third stage in the management transfer is the actual implementation of plan of action conceived, developed and agreed upon between DOI and WUA. These include

Box-5. Framework for Management Transfer Adopted by DOI



Source: Laitos and Rana, 1992

programs of canal operation, deferred and regular maintenance, payment for operation and maintenance etc. Extensive training of water users, WUA functionaries and agency personnel are to be organized to develop and strengthen their capabilities in such areas as communication and leadership, accounts and record keeping, canal operation and maintenance and improved on-farm practices. The full implementation of management transfer is expected to take a course of 3-5 years depending upon the nature of a system and the capabilities that the WUA develops over time.

A time line of events and processes, beginning the date of initiation of participatory processes to date, and their out comes in PIS are illustrated in Table-2.1. The following sections provide a discussion on the processes that were adopted in Panchakanya in designing the course of actions, plans and programs for canal operation, repair and maintenance and resource mobilization that eventually led to complete transfer of the system from DOI to WUA.

2.2 Evolution of WUA in Panchakanya

2.2.1 The Process

The process of formation of WUA in Panchakanya began with the organization of a meeting of water users, local leaders and NLIP/DOI officials on April 18, 1994 at Khageri Headwork to discuss the proposal of participatory management. About three hundred water users and invitees attended the meeting. A 13 member committee was constituted in the meeting to draft the constitution of WUA in Panchakanya. The members in the committee also included a sociologist from IMP/DOI to assist the users in the process of constitution drafting. The committee members interacted among them several times and the draft constitution was discussed in yet another meeting of water users on April 27, 1994 where several modifications and changes were suggested by the water users in the draft constitution.

Personnel from NLIP/DOI office were deputed to prepare a record of water users served by each branch canal/outlet of the system, their land holding size and the potential and actual area under irrigation. This became the basis for organizing the users at the branch and outlet levels. The inventory submitted by NLIP/DOI estimated 508 users in a total of 268.75 ha in all the outlets and branch canals of the system. (see Table-1.2)

Table-2.1. Time Line of Evolution of WUA in Panchakanya Irrigation System (PIS)

Date	Event	Outcome
2050 Chaitra 31 (April 12, 1994)	Notification issued by NLIP/DOI to organize a meeting of the Water Users to discuss the proposal of joint management process in PIS.	
2051 Baisakh 5 (April 18, 1994)	A meeting of Water Users called at the Head works of Khageri, including water users, local leaders and NLIP/DOI officials to discuss the proposal of joint management process in PIS. A 13 member committee was constituted to draft the constitution of WUA.	Beginning of Joint management program in PIS
2051 Baisakh 5-15 (April 18-28, 1994)	Personnel deputed from NLIP/DOI helped preparing records of area under irrigation under each branch, tertiary and outlets of the system, number of users, their landholding size etc.	Data needed to initiate the institutional development process were collected.
2051 Baisakh 22-24 (May 5-7, 1994)	Election of functionaries for the branch level committees was completed. General Assembly Members were elected with one member from each of 15 bigha under irrigation.	1st election of Functionaries for the lower tiers of WUA that led to the beginning of organized participation of users in governance of the system.
2051 Baisakh 26 (May 9, 1994)	1st election of functionaries for the WUA Main Committee that included 4-functionaries-chairman, vice chairman, Secretary and treasurer, and 9 members	Completion of election of functionaries at all tiers of the federated organization of WUA.
2051 Baisakh 26 (May 9, 1994)	Decision made by General Assembly to enact the constitution drafted by the constitution drafting committee and initiate the process of registration of WUA. Decision was made for the users to obtain membership of WUA by paying a membership fee of NRs.10.	Beginning of formalization of users' claim on water by setting boundary rules- the rules for inclusion and exclusion of users.
2051 Jestha 25 (June 8, 1994)	Decision made in the main committee to draft Operational Rules and Regulations of WUA. The draft Rules and Regulations were enacted with the Main Committee decision of 2052 Shrawan 22	Beginning of operation and management of the system under the provisions of written rules.

	(August 7, 1995) that laid out frameworks of rules for membership, share administration, water allocation, resource mobilization, fines and sanctions, monitoring and preservation/conservation of physical infrastructure.	
2051 Mangsir 15 (December 1, 1994)	Beginning of IMTP involvement in PIS. Decision made to open the bank account of WUA.	PIS was adopted as one of the sub-projects under IMTP to support management transfer process. A seven members sub-project management committee was constituted with the WUA representatives under the chairmanship of NLIP chief.
2051 Marga 22 (December 8, 1994)	Main committee made decision to collect irrigation service fee @ 40 per bigha per year beginning the fiscal year of 2051/52 (1994/95).	Initiation of ISF Collection
2052 Shrawan 27 (August 12, 1995)	General Assembly made decision to initiate the process of developing action plan for rehabilitation and improvement of the system under IMTP and that the WUA would take-over the operation and management of the system after the completion of rehabilitation and improvement.	Initiation of identification of rehabilitation and improvement needs under IMTP.
2052 Paush 29 (January 13, 1996)	Decision made by the main committee to operate an office of the WUA in a rented room at Bhanu Chok/Ratanagar.	Initiation of regular office of the WUA
2052 Falgun 5 (February 17, 1996)	Beginning of physical rehabilitation and improvement works under IMTP.	Construction works for the 1 st phase of rehabilitation and improvement began. WUA deputed personnel for supervision and monitoring to ensure construction quality.
2053 Jestha 18 (May 31, 1996)	Second term election of functionaries at all tiers of WUA.	
2053 Ashwin 5 (September 21, 1996)	Decision made by general assembly to raise ISF @ NRs. 60/bigha/crop.	
2053 Paush 12 (December 27, 1996)	Introduction of share system to define users' right on water. One share of water in the system was defined to be equivalent to 1 kattha of land. All the users were	Initiation of operation and management of the system as a corporate body with users having defined claim on water and resource mobilization obligation depending upon the

	required to register share with the WUA depending upon land holding size.	land holding size.
2054 Baisakh 24 (May 6, 1997)	Decision made by the general assembly to take-over the part of the system rehabilitated under IMTP.	Beginning of system turn-over.
2054 Ashadh 2 (June 16, 1997)	Decision made by the main committee to charge a fixed sum of fee to the individuals and institutions coming to PIS for observation visits/study/research etc.	Beginning of exploring other sources for financial resource mobilization besides regular ISF, membership fee and share registration fee.
2054 Ashadh 20 (July 4, 1997)	Decision made by the general assembly to take-over the operation and management of the system from DOI/HMG-N. This included the transfer of use right of all the physical structures pertaining to the system and the land in possession of the system.	
2054 Shrawan 27 (August 11, 1997)	Decision made by the main committee to install staff gauges at several locations in the main canal to measure and record the canal flow.	Beginning of efforts towards scientific flow monitoring and water allocation on the basis of volumetric flow in the system
2054 Mangsir 28 (December 13, 1997)	Turn-over of PIS to the WUA in a formal ceremony organized in the presence of Director General of DOI. A total of 141 persons including WUA functionaries, user farmers, representatives of line agencies, GOs, NGOs and DOI officials were present on the occasion.	Formal transfer of use right and operation and management of the system to the WUA.
2054 Paush 4 (December 19, 1997)	Decision made in the general assembly to enact the amendment in the constitution of WUA and new operational rules and regulations to match with the changes in the structural attributes of the system brought through rehabilitation and improvement under IMTP.	Restructuring of WUA organization consistent with the physical layout of the system.
2055 Ashwin 20-24 (October 6-10, 1998)	Third election of functionaries at all tiers of WUA within the framework of organizational structure as per the amended constitution. A regulation for election process was enacted by the main committee on 2055 Bhadra 27 for election of functionaries at all tiers of WUA.	Beginning of independent system operation and management by the WUA.

Source: WUA Records

A two-tiered structure of WUA organization was conceived and proposed in the draft constitution with a main committee at the main system level and branch committee at the branch and outlet level (Fig.4). Any user, either tenant or owner operator, was eligible to obtain membership upon payment of membership fee set by the WUA. WUA general assembly members were proposed to be elected from constituent branch and outlets on the basis of the area under irrigation- one member to represent in the general assembly from 15 bighas of land under irrigation. Since there were many outlets with less than 15 bighas under irrigation, a definition of "branch" was conceived and stated in the constitution wherein the outlets with less than 15 bighas under irrigation were combined with adjacent branch or outlet canals to ensure representation of users from such outlets in the general assembly. Therefore meaning of "branch" at that time was not a branch canal but an area to constitute branch level committee to ensure representation of users in general assembly from all parts of the system. The conceived definition of "branch" was as shown in Box-6.

Box-6

Branch No.1 - Outlet Nos. 1, 2 and 3
Branch No.2 - Outlet Nos. 4 and 5 and half of branch canal No.1
Branch No.3 - Half of branch canal No.1
Branch No.4 - Outlet No. 6 and branch canal No. 2
Branch No.5 - Outlet No. 7 and branch canal No. 3
Branch No.6 - Outlet No. 8 and branch canal No. 4
Branch No.7 - Branch canal No. 5
Branch No.8 - Branch canal No. 6
Branch No.9 - Branch canal No. 7

At the "branch" level a 5-member branch committee was proposed to be elected by the branch level assembly of the users including a chairperson, secretary and 3 members. Where possible election of a women member in the branch level committee was emphasized. Depending upon the area under a "branch", required number of representatives for general assembly were proposed to be elected by the branch level assembly of the users.

At the main system level, a 13-member main committee was proposed to be constituted including- a chairperson, vice-chairperson, secretary and treasurer as functionaries, elected from among general assembly member and the 9 chairpersons of the constituent "branch committees" were to be ex-officio members in the main committee.

The schedule of 1st term election of WUA functionaries at "branch committees" and main committee is shown in Table-2.2. A list of functionaries elected at each "branch committee", general assembly and main committee in the 1st election of WUA is given in Annex-I.

The tenure of functionaries at each level of WUA organization was for two years term, as stated in the constitution. The 2nd election of WUA at all levels were conducted during May 27-30, 1996. For the schedule of the election process for the 2nd term election refer to Table-2.2. The list of functionaries elected in the 2nd term election at all levels of WUA is given in Annex-II.

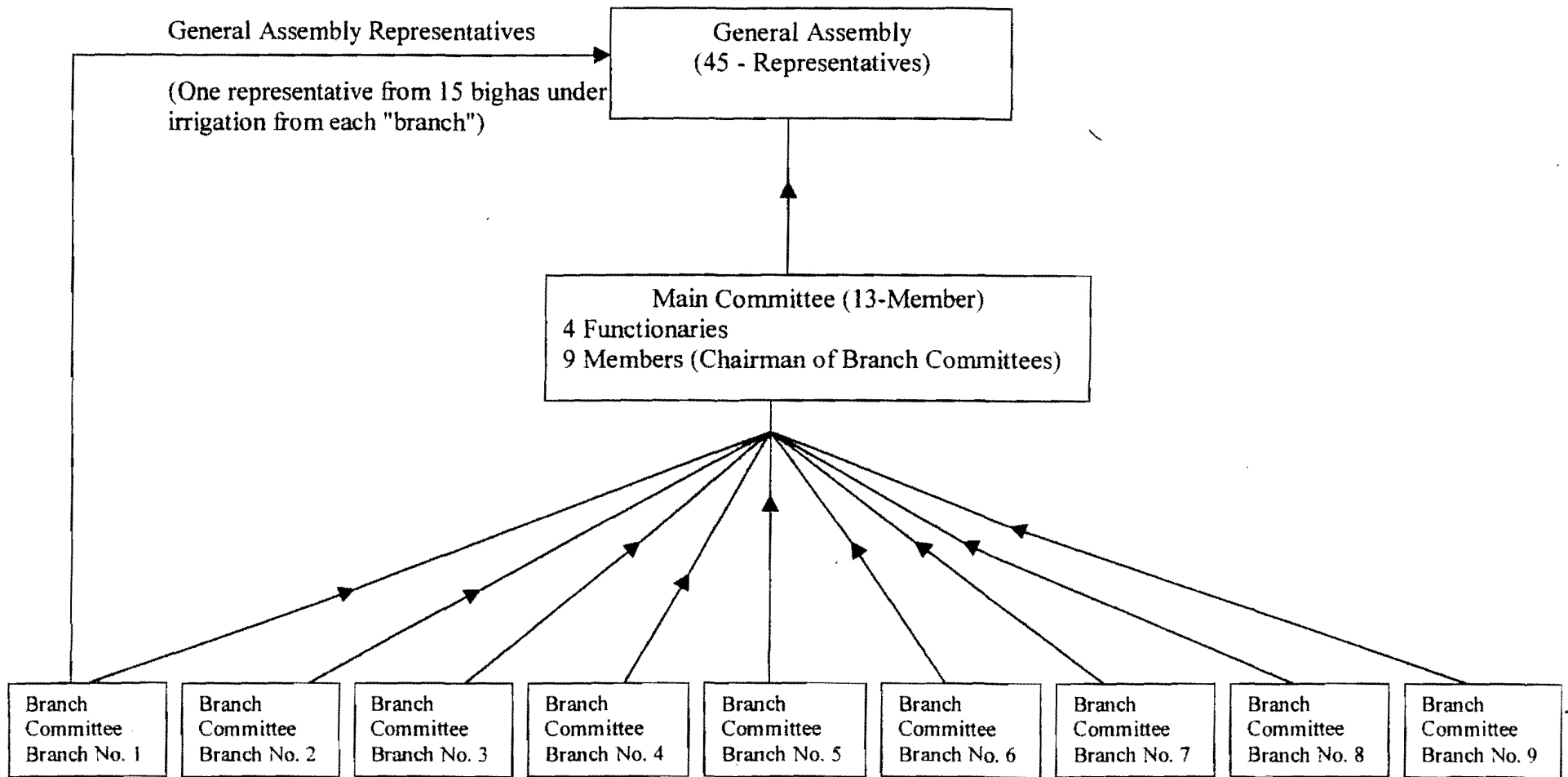


Fig. 4. Organoram of WUA Prior to Constitutional Amendment of December 19, 1997

The 1st and the 2nd elections were conducted as per the provisions in the WUA constitution and organizational structure illustrated in Fig. 4. This organizational structure was later found to be not consistent with the physical layout of the system and the hydrologic boundary. Therefore, an amendment in the constitution was proposed that was enacted by the general assembly of the WUA on December 19, 1997. The changes brought in the organizational structure of WUA and the representation at each level of organization with the constitutional amendment were as under-

- The WUA was proposed to have two tiers of organization but with two levels at the lower canals- branch committee at each branch level and outlet committee at each outlet level (Fig. 5).
- At the branch and outlet canal level, a 5-member branch or outlet committee was proposed to be constituted including two functionaries (chairperson and secretary) and three members, elected by the branch or outlet assembly of the users. One woman membership in the branch or outlet committee was made compulsory with the constitutional amendment.
- General assembly members were to be elected by the users assembly at each branch and outlet canals on the basis of one member representative from each of 15 bighas under irrigation. For the election of general assembly representatives from those outlets with less than 15 bighas under irrigation, provision was made to elect representatives by combining the area of that outlet canals with the adjacent outlet/branch canal. In addition to elected general assembly representatives, provision was also made for ex-officio representation of chairperson and secretary from each branch level committee and chairperson from each outlet level committee in the general assembly. However, though such ex-officio representatives were made eligible to cast votes, they were not eligible to contest the election for any position of the functionaries in the main committee. With these provisions the number of representatives in the general assembly increased to 110.
- The main committee was proposed to be constituted with a total of 16 functionaries and members as under:
 - Three functionaries- chairperson, vice-chairperson and secretary to be elected by the members of the general assembly.
 - Eight chairpersons from each of the eight branch committees as ex-officio member.
 - Two ex-officio member representatives from the constituent outlet committees nominated from among the chairpersons of the outlet committees- as to one member from outlet No. 1 to 5 and another member from outlet No. 6 to 10.
 - Two members nominated/elected from among the general assembly members from branch canal No. 1 and 5, due to area larger than 50 hectares in command of both these branches.
 - One woman member nominated/elected from among the general assembly members.

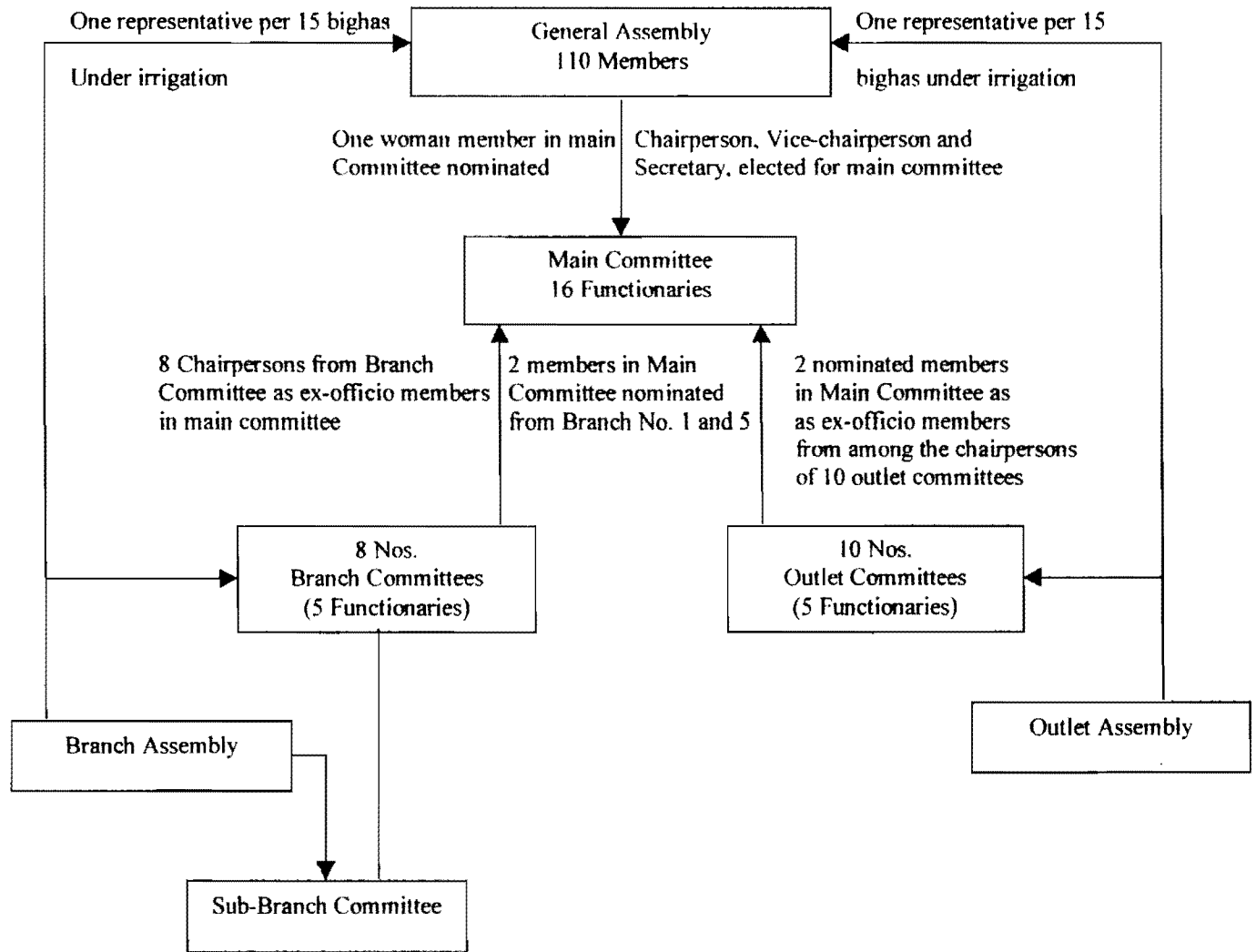


Fig. 5 Organogram of WUA in PIS as per Constitutional Amendment of December, 1997

The 3rd term election of WUA functionaries at all levels, as per the provisions in the amended constitution, were completed during October 6-10, 1998. The schedule of election and the functionaries elected at each level is listed in Tables- 2.2. The list of functionaries elected in the 3rd term election at all levels of WUA is given in Annex-III.

Table-2.2 Schedule of Three Elections of WUA

Level of WUA Organization	1 st Election	2 nd Election	3 rd Election
Election of Functionaries for Branch/Outlet Committees	2051/01/22 (Branch No. 1,2,3,4) 2051/01/23 (Branch No. 5,6,7,8) 2015/01/24 Branch No. 9	?	?
Election of Functionaries for Main Committee	2051/01/26	?	?

2.2.2 Registration of WUA

The process of registration of WUA was initiated upon completion of 1st term election at all level of WUA. The draft constitution was formally inacted in the duly elected general assembly of the WUA on May 9, 1994) and authorized the main committee to initiate the process of registration. The main committee filed the application to the District Water Resources Committee. The provisions of the WUA constitution were discussed in the District Water Resources Committee meeting of May 30, 1994. The District Water Resources Committee required following provisions of the constitutions changed while issuing registration certificate.

"In the draft constitution submitted for registration the source of PIS was defined to include Battar Khola intake also that had been developed for augmented supply at the main intake of Panchnadi. The District Water Resources Committee issued a directive to make the definition of source in the constitution changed on the ground that inclusion of Battar Khola intake as source in PIS could influence downstream use."

2.3 Capacity Building of WUA

After the formation of WUA, development of WUA constitution and its' registration as a statutory body, the DOI concentrated on capacity building of WUA through series of training programs organized on different aspects of operation and management of irrigation system. The members of consulting team under CADI/DOI developed series of training modules that were conducted in PIS. These training modules were scheduled to match with the phases of management transfer process in PIS.

The training programs that were conducted in PIS are illustrated in Table-2.3. The total number of participants who have attended one or more training in PIS is 329 and the total number of training days have been 31. Of the different training programs that were conducted in PIS, the users and functionaries of WUA feel that those on share system administration and financial management and record keeping have been extremely useful for WUA in institutional development.

2.4 Decision Making

The irrigators in PIS have had prior experience of collective decision making. The informal executive committee existing prior to initiation of joint participatory management program in 1992, had been making decisions pertaining to water allocation and repair and maintenance in the system. Though this committee did not have defined procedure of electing the functionaries, definite procedure of involving the users from different parts of the system in the decision making and mechanism of communicating the decisions, it definitely had trend of decision making though with the participation of few individuals that was need based and problem solving in nature. Further, PIS was developed with the expansion of a farmer managed irrigation system having long traditions of users' participation in decision making and resource mobilization.

With the current efforts of irrigation management transfer and evolution of WUA, general assembly and main committee have evolved as two important decision making arena within WUA. The WUA constitution has stipulated all the constitutional authority vested to general assembly, that includes- authority of constitutional amendment, approval of rules and regulations developed by the main and branch committees and policy decision on outstanding issues.

The regular general assembly in PIS has been proposed to be called two times in a year. Provision has also been made in the constitution for general assembly to be called any number of times in case of needs and decision to this effect by the main committee. If 25 percent members of the general assembly file written application with genuine concerns to call general assembly, the main committee chairman would be obliged to call the general assembly within 15 days of such application. All the general assembly members are to be notified at least 5 days in advance about the date, time, venue and agenda to be discussed. Attendance of 51 percent of total members is the required quorum for the general assembly.

Table-2.3 Training Programs Organized in PIS for Capacity Building of WUA

S.No.	Particulars of Training	No. of Participants	Duration	Remarks
1	Administration and Financial Management Training	19	2 Days	Main Committee Functionaries -12 Branch Committee Functionaries-5 Users - 2
2	Share System Development and Share Administration Training	22	7 Days	Main Committee Functionaries -13 Branch Committee Functionaries-8 Users -1
3	Construction Management Training	6	2 Days	Main Committee Functionaries - 6
4	Awareness Training on Irrigation Management Transfer Process	2	2 Days	Main Committee Functionaries - 2
5	Awareness Training on Irrigation Management Transfer Process	36	4 Days	Branch Committee Functionaries-36
6	Monitoring and Evaluation Sensitization Training	5	2 Days	Members of SMC - 5
7	Construction Management and Quality Control Training	4	2 Days	Members of SMC - 4
8	Mass Awareness Workshop on Participatory Irrigation Management Transfer	148	3 Days	Functionaries of Branch Committee and Leader Farmers
9	Water Flow Measurement Capacity Building Training	13	2 Days	Main Committee Functionaries - 9 Main Canal Karyadal - 2 Branch Canal Karyadal - 9
10	Women Users Sensitization Training	17	1 Day	Main Committee Functionaries - 2 Women Users - 15
11	Training on Role and Obligations of Women Users in Irrigation Management Transfer Program	17	1 Day	Women Users - 17
12	Training on Financial Record Keeping	10	1 Day	Secretary of Main and Branch Committees
13	Canal Operation and Maintenance Training	30	2 Days	Main Committee Functionaries - 10 Branch Committee Functionaries-19 Karyadal Member - 1
	Total No. of Training Program = 13	329	31 Days	Main Committee Functionaries - 66 Branch Committee Functionaries-86 User Farmers - 177

The constitution of WUA also stipulates democratic process in the decision making in the general assembly. All the users are though welcome to participate in the general assembly only designated representatives (110 representatives as per the amended constitution) can vote on any decision to be made. Any decision made through general consensus or majority vote is enacted by the WUA.

At the branch canal and outlet level, provision of branch assembly and outlet assembly has been made in the constitution. All the users within a branch or outlet are members of the respective branch and outlet assembly. All the branch and outlet assembly are eligible to make decisions pertaining to specificities of the respective branch or outlets but within the framework of the WUA constitution, policy guidelines of general assembly and rules and regulations formulated by the WUA.

At the main canal level, the main committee has the authority of decision making on day-to-day operation and management of the system but within the framework of WUA constitution and policy guidelines of general assembly. Any decision made by main committee not stipulated in WUA constitution or in the rules and regulations approved by general assembly is subjected to approval of general assembly. The decision making of main committee are limited to system administration, including- formation of annual work-plan, resource mobilization, canal operation, repair and maintenance, establishing working relationship with DOI and other organizations, financial management and monitoring and evaluation.

The main committee decisions are to be taken with general majority of the functionaries and members in the main committee. The required quorum of main committee is 51 percent of all the functionaries and members in the main committee. The regular meeting of main committee is to be called once in each month. In case of needs, the main committee chairman can call the main committee meeting as many times as required. In addition, the chairman will be obliged to call the meeting incase of written request made by one third of the members in the main committee. The frequency of main committee meeting by different months and the pattern of attendance of functionaries and representatives in the main committee meeting is illustrated in Table-2.4. By the end of year 2055 (1998-99) a total of 60 main committee meeting had been conducted in PIS since the initiation of management transfer program. In general the frequency of main committee meeting is found to be higher in Asar, Shrawan and Bhadra than in other months, probably due to need for frequent decision making pertaining to water allocation during these monsoon months. There has been so far only one instance when main committee meeting could not be conducted in the absence of required quorum. In general, the mean attendance of functionaries and representatives in the main committee meeting has been found to range between 53 percent to 77 percent in different months with the average attendance in all the 60 meeting to be as high as 71.4 percent.

The kinds of decisions made in the main committee meeting are illustrated in Table-2.5. Since the initiation of irrigation management transfer in PIS, the main committee has been an important arena for decision making particularly those pertaining to day-to-day operation and management of the system. In general there has been larger

Table-2.4 Frequency of Main Committee Meeting by Months and Attendance Pattern of Functionaries

Year	Frequency of Meeting												
	Baisakh	Jestha	Asar	Srawan	Bhadra	Ashwin	Kartik	Mangsir	Paush	Magh	Falgun	Chaitra	Total
2048	-	-	2(77.0%)	2(86.0%)	-	-	-	-	-	1(73.0%)	-	-	5(78.5%)
2049	-	-	2(54.0%)	2(68.0%)	-	1(54.0%)	-	-	-	-	-	1(54.0%)	6(54.0%)
2050	-	-	1(63.0%)	2(59.0%)	-	-	-	-	1(73.0%)	-	-	-	4(63.0%)
2051	-	3(94.0%)	2(76.0%)	2(88.0%)	-	1(53.0%)	-	1(92.0%)	-	-	-	1(92.0%)	10(82.5%)
2052	-	-	-	2(84.0%)	-	-	1(53.0%)	1(61.0%)	1(61.0%)	1(53.0%)	2(65.0%)	1(53.0%)	9(61.4%)
2053	2(46.0%)	1(53.0%)	3(64.0%)	3(71.0%)	3(69.0%)	-	-	1(53.0%)	-	1(50.0%)	-	1(76.0%)	15(61.4%)
2054	1(84.0%)	-	2(80.0%)	2(65.0%)	2(61.0%)	-	-	1(100.0%)	-	1(53.0%)	1(61.0%)	-	10(72.0%)
2055	1(69.0%)	1(84.0%)	1(84.0%)	-	2(73.0%)	-	1(94.0%)	1(76.0%)	2(85.0%)	3(80.0%)	2(85.0%)	2(79.0%)	16(81.0%)
Total	4(66.3%)	5(77.0%)	8(76.0%)	9(77.0%)	7(67.7%)	1(53.0%)	2(73.5%)	5(76.0%)	3(73.0%)	6(59.0%)	5(70.3%)	5(75.0%)	60(71.4%)

Source: WUA Records

Values in the parenthesis are mean percentage of attendance of representatives in the Main Committee in specific month/year

A 11 member informal executive committee was existing in PIS prior to 2051 B.S. (Shaded details)

Table-2.5. Nature of Decision Making in Main Committee by Month since Formation of WUA to 2055 B.S.

S.No.	Types/Nature of Decision	Year	Months											Total		
			Baisakh	Jestha	Asar	Shrawan	Bhadra	Ashwin	Kartik	Mangsir	Poush	Magh	Falgun		Chaitra	
I.	Decisions Pertaining to WUA Organization, Administration and Capacity Building	2048														
		2049														
		2050														
		2051		4	2					1						7
		2052				1						1		1		3
		2053					3						2			5
		2054	1		1	3					1		1	1		8
2055	5	1			5		1	2	3			6		23		
	Total		6	5	3	4	8		1	4	4	3	8		46	
ii.	Coordination with DOI and Other Line Agencies	2048														
		2049														
		2050														
		2051														
		2052														
		2053	1		3	1						1			6	
		2054			2	1	1						1		5	
2055	2		1		1		1		1		1	1	7			
	Total		3		6	2	2		1		1	1	2	18		
iii.	Rehabilitation, Improvement and System Upgrading	2048														
		2049														
		2050														
		2051						1							1	
		2052										2			2	
		2053				2									2	
		2054			3	1									4	
2055					1		1		1	2			5			
	Total			3	3	1	1	1		1	4			14		
iv.	Resource Mobilization	2048														
		2049														
		2050														
		2051			1					2					3	
		2052													4	
		2053				2	1						1		7	
		2054	1		1		1			2		1	1		4	
2055	1	1			1					1			4			
	Total		2	1	2	2	3		4		2	2		18		

v.	Repair and Maintenance	2048												2
		2049					1							2
		2050												5
		2051		1	1	1				1				4
		2052				1						1		2
		2053		1	1					1				3
		2054	1		2		1					2		6
		2055		1										1
		Total	1	3	4	2	1			2		3		16
vi.	Water Allocation and Distribution	2048			2	1								3
		2049				2								2
		2050				2								4
		2051			1	1								2
		2052				2								2
		2053			3	4	3							10
		2054				2	2							4
	2055	1		1						1		1	4	
	Total	1		5	9	5				1		1	22	
vii.	Formation of Rules and Regulations	2048												2
		2049												4
		2050												4
		2051		1									1	2
		2052				1							1	2
		2053												1
	2054								1				1	
2055					1							1		
	Total		1		1	1			1			2	6	
viii.	Fines and Penalties	2048				1								1
		2049				3								3
		2050												1
		2051				1								1
		2052												1
		2053			1									1
	2054					1							1	
2055	1		1						1			3		
	Total	1		2	1	1				1			6	
ix.	Monitoring and Record Keeping	2048												1
		2049												1
		2050												1
		2051			1	1					1		2	5
		2052							1		1		2	4
		2053	1			2			2		3			8
	2054	1			2					1			4	
2055	1								1		1	3		
	Total	3		1	5			1	2	1	6	2	3	24

Source: WUA Records

A 11 member informal executive committee was existing in PIS prior to 2051 B.S. (Shaded details)

number of decisions pertaining to WUA organization and internal administration followed by coordination with DOI and with other line agencies and resource mobilization. There have been more decisions of these nature in PIS in the earlier stage of management transfer. With time however the decisions of these nature may be expected to reduce while those pertaining to repair and maintenance and water allocation may be expected to increase.

The decision made in the main committee is communicated through the representatives from the constituent branch or outlet committees in the main committee. In the present organization of WUA, the chairman of constituent branch and outlet committees are ex-officio members in the main committee.

At the branch and outlet level, the branch committees and outlet committees have the authority to take decisions on day-to-day operation and management but within the framework of WUA constitution, policy guidelines of general assembly and the main committee directives. The decision making in the branch or outlet committees are similar to those in the main committee, limited to- canal operation, resource mobilization, repair and maintenance and execution of rules and regulations specific to the needs of branch/outlet. The meeting of the branch and outlet committees are to be called minimum of two times in a year.

2.5 Formation of Rules and Registrations

2.5.1 The Process

After completion of 1st term election of functionaries at all levels of WUA organization and registration of WUA, the need of operational rules and regulations was realized. The main committee meeting of June 8, 1994 constituted a five member committee from among the functionaries and members to draft operational rules and regulations of the WUA. The committee could not work to produce the document within the due date, therefore the main committee deputed the then secretary to draft the rules and regulations and produce it for the discussion in the main committee. The draft rules were thoroughly discussed in the main committee meeting of August 7, 1995 and the general assembly of August 12, 1995 granted approval to enact the Rules and Regulations of WUA of PIS. This document essentially consisted of compilation of decisions made by the general assembly and the main committee with date at different times in the forms of governance rules of the WUA.

The physical and institutional characteristics of the system went through changes with the rehabilitation and improvement under IMTP. This brought changes in the dependable irrigation supply in the system and the area under irrigation was also tremendously increased with time. The WUA amended the constitution to make the organization of WUA consistent with the physical layout and changed structural characteristics of the system. The WUA therefore realized that new set of operational rules and regulations were needed for governance and management of the system. New Rules and Regulations were enacted by WUA in 1997/98.

General assembly and main committee are the two decision making arena for rule formation. The proposal for the formation of new rules or amendments in the existing rules are brought in the main committee meeting. Upon developing consensus in the main committee, the proposal is brought for discussion in the general assembly. Any rule is enacted only after formal approval of the general assembly.

2.5.2 The Rules-in-Use in PIS

The rules-in-use in PIS including the rule forming arena and rule enforcing body is compiled in Table-2.6. This compilation has been based on review of constitution of WUA, operational rules and regulations of 1996 and 1997/98, minutes of meeting of general assembly and main committee and discussion with the main committee functionaries. PIS has well define boundary rules that clearly sets out criteria to be appropriator in the system. The boundry rules are uniformly applicable irrespective of location of users in the system, however a set of rules in the forms of share registration fee, irrigation fee and labor fee for repair and maintenance, are in place, to ensure proportional equivalence between benefits and costs. In PIS, elaborated rules and mechanisms have evolved over time for water allocation and distribution. Water allocation schedules are prepared by the main committee by collecting demand from the users and all the users are obliged to irrigate under the pre-set allocation schedule. The allocation schedule decided by the main committee is also to be effectively monitored by the fnctionaries of branch committee at the branch level and by the member of the *Karyadal* and functionaries at the main committee. Any irrational behaviour of the irrigators or the functionaries of the main or branch committee are to be checked through elaborated payoff rules. Mechanisms of graduated sanctions exist in PIS for repeated violation of rules.

Table-2.6 Rules-in-use in Panchakanya Irrigation System

Rule Types	Level	Kinds of Rules-in-use	Rule Forming Area	Rule Enforcing Body
Boundary Rules (Eligibility for Appropriation)	Users	<ul style="list-style-type: none"> - Owner operator or tenant in service area - Must obtain membership of WUA upon paying NRs. 10.00, to be renewed every year - Must obtain share upon paying a share fee @ NRs. 3.00/kattha of land (e.g. if a farmer's land to be irrigated is 1 bigha, he must register 20 shares upon paying share fee of NRs. 60.00, one time) - Appropriation right is transferred with the sale of the land but the buyer must get the share transferred to his/her name upon paying NRs. 20.00, one time. - Appropriation right can be inherited. - Uniform appropriation rule for every one and every part of the system. 	WUA General Assembly	Main Committee
	Branch/Outlet Level	<ul style="list-style-type: none"> - In case of need to open new branch/outlet/tertiary from the main canal one time entry fee @ NRs. 500.00/bigha must be paid to WUA to obtain entry permission. 	WUA General Assembly	Main Committee
Authority and Scope Rules (Conditions for appropriation, quantity and time)	Farmers Field/ User	<ul style="list-style-type: none"> - Must submit demand - Can withdraw a fixed amount depending upon number of registered share - Must withdraw at fixed time slot - Must withdraw at pre-set turn (if required) - Must withdraw at fixed order - Must withdraw at fixed location 	Main committee	Branch committee/ Outlet committee
	Branch Canal/ Outlet level	<ul style="list-style-type: none"> - Must submit demand - Can withdraw a fixed amount depending upon total number of shares vis-à-vis total land under irrigation - Must withdraw at fixed time slot (if required) - Must withdraw at pre-set turn (if required) 	Main Committee	Canal Management Work Force (Karyadal member)
Rules for proportional Equivalence (Proportional equivalence between benefit and costs)	Branch Canal/ Outlet Level	<ul style="list-style-type: none"> - Must pay irrigation service fee @ NRs. 150/ha/crop/rice (both for monsoon and spring) and @ NRs. 75/ha/crop for low water demanding winter crops - Must contribute labor for required number of days for annual maintenance in main canal (at present 2-4 labor days/ bigha) or 	Main committee	Canal Management Work Force (Karyadal members) Branch Committee

		<ul style="list-style-type: none"> - pay labor fee @NRs. 200/day of labor required in advance - All off-takes from main canal open if available supply in main canal \geq 1200 lit/sec, timed allocation to branch canals and also rotation between head and tail branches (3 days at present) when available supply decreases - Volumetric water allocation @ 3 lit/sec/ ha for spring and monsoon rice (yet to enforce) - Flow gauging at different reaches by members of Karyadal 		
Information/ Monitoring Rules (Rules for auditing physical conditions and/or users behavior)	Branch Canal/ Outlet Level	<ul style="list-style-type: none"> - Timed irrigation distribution based on area - Adjustment in distribution possible depending only in case the users demand be critical. - Branch Committee/ Outlet Committee must keep the branch/outlet users informed about physical conditions of branch/outlet level canals and related structures - Branch committee / outlet committee must keep the users informed in case of failure to deliver water on the scheduled date and time - The users must submit the schedule of water demand to branch/outlet committee one month prior to cropping with the mention of crop(s) and area to be irrigated - Branch Committee responsible to monitor the schedule of water delivery within the branch and make adjustment in the schedule in case the users' demand be not met - Branch committee responsible to monitor and identify unauthorized water use - Accountability of users to keep the branch committee informed of unauthorized use 	Main Committee Branch Assembly/ Outlet assembly/ Main Committee	Branch Committee Branch Committee/ Outlet Committee
	Main Canal Level	<ul style="list-style-type: none"> - Main committee must keep the general assembly informed of physical conditions of main canal and related structures - Main committee must keep the branch committee informed in case of failure to deliver water on scheduled date and time - Main committee responsible to monitor the schedule among branches/outlets and make adjustment in the schedule incase the users demand be not met - Main committee responsible to monitor unauthorized water use from main canal - All users obliged to keep the main committee informed of unauthorized water use 	General Assembly/ Main Committee	Members of Karyadal

Payoff Rules (Rules for reward/ penalty/fines/ sanctions)	Users	<ul style="list-style-type: none"> - Fine equal to membership renewal fee to be paid for the failure to get the membership renewed every year within due date. - Fine of NRs. 100.00 along with the share registration fee to those who failed to obtain share for the land under irrigation - Fine equal to irrigation service fee for failure to clear the irrigation service fee within due date - Fine equivalent to four times the cost incase of attempt to moderate any canal or structures at any level of the system - Fine equal to NRs. 15,000.00 plus cancellation of membership and denial of access to water for any attempt to damage the canals or related structures - Fine equal to NRs. 500.00 for the first attempt, NRs. 1000.00 for the second and NRs. 2000.00 for the third, for water theft. Incase of fourth such attempt, the main committee may decide to cancel the membership and deny access to water 	General Assembly/ Main Committee	Branch/Outlet Committee and Main Committee
		<ul style="list-style-type: none"> - Fine ranging from NRs. 500.00 to NRs. 5000.00 for any attempt of not following the schedule of water distribution communicated by WUA - Fine equal to two times the prevailing wage rate for failure to mobilize labor or payment of labor fee at the time of repair or maintenance. Cessation of water access for denial thereof. - All users obliged to use water as per demand within the schedule set by the WUA. Fine equal to two times the irrigation service fee could be imposed in case of the attempt of water misuse. 		
	Branch Committee/ Outlet Committee	<ul style="list-style-type: none"> - Fine ranging from NRs. 10.00 to 100.00 could be imposed on the functionaries of the branch/outlet committees for their failure to discharge the duties as defined by the constitution and rules and regulations of the WUA - Denial of access to irrigation to those branch/outlet canals for failure to mobilize labor for annual repair and maintenance of the main canal. Access could be granted only upon payment of fine (either in cash or in labor) equal to the labor mobilization due. 	General Assembly	Main Committee
	Main Committee	<ul style="list-style-type: none"> - Fine ranging from NRs. 10.00 to 100.00 could be imposed on the functionaries of the main committee for their failure to discharge the duties as defined in the constitution or rules and regulations of the WUA 	General Assembly	General Assembly/Main Committee
	Miscellaneous	<ul style="list-style-type: none"> - Fine upto NRs. 10,000.00 could be imposed on individuals/organizations on any attempt to encroach within the land in possession of the system or within the watershed of the 		

		<p>source</p> <ul style="list-style-type: none"> - Fine ranging from NRs. 500.00 to NRs. 1000.00 could be imposed incase of attempt by any individual to cultivate on the canal banks or in the land within the right-of-way - Confiscation of equipment incase of attempt to pump water from the main canal without prior permission of main committee - Main committee may grant access of water supply in fish ponds upon charging a fee four times the regular irrigation service fee incase such access do not affect downstream demand of the users - Fine ranging from NRs. 50.00 to NRs. 2000.00 on these individuals who attempt to bring their livestock for grazing on the canal banks or on any land in possession of the system - Fine ranging from NRs. 20.00 to NRs. 1000.00 on those individuals who attempt to throw dirt or household effluents in the main canal or attempt to plant trees along the canal bank or within the right-of-way 		
Rules for Conflict Resolution (Conflict among users and WUA Functionaries)	Users	<ul style="list-style-type: none"> - Concerned branch/outlet committee responsible for resolving the conflict among the users pertaining to irrigation water use - Users eligible to file petition to main committee incase of failure of concerned branch/outlet committee in resolving the conflict - Users eligible to file petition to the main committee against any of the functionaries of the concerned branch/ outlet committee however incase of failure to prove charge such petitioner be liable to fine of NRs. 50.00 	General Assembly/ Main Committee	Branch/Outlet Committee/Main Committee
	Branch/Outlet Committee	<ul style="list-style-type: none"> - All the branch/outlet committee may file petition to the main committee on all kinds of conflict pertaining to irrigation water use 	General Assembly/ Main Committee	Main Committee

2.6 Membership and Share System Administration in PIS

The first record of the irrigators in PIS was prepared in April, 1994 (see table-1.2) at the time of initiation of joint management process. Later several discrepancies in this record were noted by WUA in terms of number of users in each branch/outlet and the area under irrigation. WUA needed to update the record of number of users in the constituent branch/outlet, therefore the WUA decided to develop and implement a set of boundary rules (see Table-2.6) to define eligibility for appropriation. All the users (owner operator or tenant) in the service area were required to obtain "membership" of WUA by paying a membership fee of NRs. 10.00 to be renewed every year. The membership remained the sole basis for eligibility for appropriation until December, 1996 until the concept of share registration was brought in the system.

The WUA realized that the "membership" alone was insufficient to ensure equity in appropriation- as to a control on quantity and time was found essential to ensure equitable access to irrigation by the users depending upon the area under irrigation and their location in the system. In December, 1994 the IMTP/DOI conducted a training program on concept and development of share system and its administration for operation and management of the system. A total of 22 participants including main and branch committee functionaries and users participated in the 7 days training program.

The concept of share administration in operation and management of irrigation system means a mechanism to mobilize resources (cash and labor) from among the users to pay for irrigation management cost proportional to quantity used by them. A user who receives X number of shares from total available irrigation supply would therefore be obliged to pay, in cash or labor, roughly X shares of total operation and maintenance cost of the system (Wilkins-Wells, 1993) Therefore, share administration aims to legitimize the users' access to irrigation under specified rules and regulations and make them obliged for paying the share of operation and maintenance cost proportional (or roughly proportional) to quantity of water appropriated.

Initially the WUA in PIS defined the "system share" on the basis of land area because system of canal flow measurement at different levels of the system was not instituted. One share was assigned to 1 *Katha* of land under irrigation.

The process of share administration in PIS began in December, 1996. All the users were required to obtain and register as many shares depending upon the area under irrigation by paying one time share registration fee of NRs. 3.00 per *Katha*. The WUA issues a share certificate (see Box-7) upon share registration. A total of 10212 shares accounting the total area of 335.26 ha have been registered by a total of 895 users at the end of fiscal year 1998/99. The existing main committee functionaries however believe that the area currently under irrigation is higher than the area for which shares have been registered with the WUA. The distribution of membership, number of registered shares and the land area for which shares have been registered by branch canals and outlets at the end of fiscal year 1998/99 is shown in Table-2.7.

पत्र कन्या सिंचाई प्रणाली
जल उपभोक्ता संस्था
चितवन, रत्ननगर
शेयर प्रमाण-पत्र

शेयर प्रमाण पत्र संख्या:-

जिल्ला चितवन न.पा/गा.वि.स..... वडा नं.
गाऊं/ टोल बस्ने श्री को नाति
श्री को छोरा यस नहर प्रणालीको जल उपभोक्ता
कृषक श्रीमान्/श्रीमती/सुश्री लाई शाखा
नं बाट जग्गा/विगाहा सिंचाई गर्न पाउने गरी
शेयर संख्या को शेयर सदस्यता प्रदान गरिएको छ ।

शाखा अध्यक्ष

सचिव

अध्यक्ष

मिति:

Table-2.7. Distribution of Membership and Registered Shares in PIS by Branch Canals and Outlets at the end of Fiscal Year 1998/99 (2055/056)

S.No.	Branch Canal/ Outlet Number	Total No. of Membership	No. of Membership Renewed	Share Registration				Area Currently Under Irrigation for which Shares are yet to be Registered ¹
				No of Registered Share	No of Users	Land Area (ha)	No of Share per User	
1	Outlet No. 1	23	13	169	23	5.51	7.35	
2	Outlet No. 2	22	13	182	22	5.99	8.27	
3	Outlet No. 3	16	12	232	16	7.65	14.50	
4	Outlet No. 4	24	22	170	24	5.57	7.08	
5	Outlet No. 5	3	3	65	3	2.14	21.66	
6	Outlet No. 6	14	8	65	14	2.11	4.64	
7	Outlet No. 7	2	1	32	2	1.05	16.00	
8	Outlet No. 8	11	10	106	11	3.45	9.64	
9	Outlet No. 9	16	7	264	16	8.73	16.50	
10	Outlet No. 10	15	8	160	15	5.24	10.67	
11	Branch No. 1	180	146	2307	180	76.14	12.81	
12	Branch No. 2	64	58	829	64	27.49	12.95	
13	Branch No. 3	25	10	560	25	18.48	22.40	
14	Branch No. 4	48	37	450	48	14.01	9.38	
15	Branch No. 5	182	140	1827	182	59.83	10.04	
16	Branch No. 6	108	73	1111	108	36.72	10.29	
17	Branch No. 7	61	31	672	61	22.09	11.02	
18	Branch No. 8	84	42	1011	84	33.06	12.04	
		898	634	10212	898	335.26	11.32	

Source: WUA Records

¹ Assessment made by main committee functionaries

2.7 Canal Operation, Water Allocation and Distribution

2.7.1 The Process

Prior to joint participatory management and irrigation management transfer program in PIS, the informal executive committee used to make decisions for canal operation, ensure gate operation, decide and implement water allocation schedule and make adjustment in the allocation schedule depending upon the need. The decisions of canal operation used to be communicated to NLIP and this used to be executed through dhalpas (water guards) and seasonal labors deputed in PIS by NLIP. For repair and maintenance of the system, the executive committee used to coordinate with the NLIP to complete needed repair and maintenance before monsoon.

For water allocation during monsoon, the informal committee used to divide the system in two sections after transplanting of monsoon paddy- the area above branch number 3 and those below branch number 3 used to get irrigation supply for fixed number of days, usually ranging from 8 to 12 depending upon the need and available flow in the canal. The decisions pertaining to rational schedule used to be communicated to the users in the different reaches of the system through representatives in the executive committee and the dhalpas deputed in the system used to be instructed for canal operation accordingly. The executive committee functionaries and representatives used to meet to decide upon next turn of schedule after the completion of one turn in all parts of the system. In the monsoon season the executive committee used to meet on an average of two times in a month to set out rational schedule. The executive committee did not have any role for water allocation during winter and spring season because irrigation in these two seasons was limited to head reaches of the system, usually upto branch number 1.

There were no mechanisms in place for monitoring and supervision to assess whether or not the demand of the users were met. The allocation schedule prepared and executed by the executive committee were not necessarily based on the demand of the users. The role of the executive committee was limited to water allocation upto the branch level only and that there were no mechanism for water distribution within the branch. This had resulted to inequitable distribution, with progressively decreasing dependability on time and amount from head to tail of the system. The area below branch canal number 5 was rarely getting any irrigation supply.

The canal operation and water allocation and distribution procedure has undergone tremendous improvement over time. This has been possible through introduction of procedure of collection of water demand from the users, physical improvements in the system, flow gauging at several locations in the system and capacity building of WUA for canal operation and planning of water distribution schedule. A canal operation manual for PIS has been developed by the consulting team of IMTP/CADI which the WUA has been taking as a reference for canal operation. Following sections discuss the process that have evolved in PIS for canal operation, water allocation and distribution and monitoring and supervision.

2.7.2 Canal Operation Work Force (*Karyadal*)

In the course of management transfer the WUA realized the need of developing a cadre of manpower trained in canal operation and day-to-day monitoring and supervision of system operation. This was found essential because it was not possible for main committee functionaries to perform canal operation and water allocation tasks on a daily basis. In August, 1997 a training program was organized in PIS on canal operation and management. A total of 13 persons participated in the training, of them 2 persons were identified to work as *karyadal* member of main committee and 9 were to work as *Karyadal* member of branch committees. At present the main committee has appointed one among the two trained members as the main committee *Karyadal* member, who is paid a salary of NRs. 1500.00 per month. The main committee *Karyadal* member is to work as appointee of main committee for day-to-day canal operation and supervision of water distribution. He is also required to keep the chairman and secretary of the main committee informed of day-to-day status of water distribution in the constituent branch/outlet canals.

2.7.3 Flow Gauging

IMTP supported PIS in system calibration and installation of staff gauges at three locations in the main canal. The main and branch committee functionaries and members of *Karyadal* were trained on flow gauging and recording the water flow at different reaches of the system. The consulting team of IMTP/CADI have also trained the main and branch committee functionaries and the members of the *Karyadal* on working out irrigation allocation schedule depending upon the level of canal flow and on canal operation. A manual for canal operation has been developed by the consultants of IMTP/CADI that has been instrumental in making the functionaries of WUA aware of strategy of irrigation allocation and canal operation based on available flow in the canal.

2.7.4 Collection of Irrigation Demand

The WUA has instituted mechanism of collection of irrigation demand from among the users. The users are required to submit their demand for irrigation several days in advance to the concerned branch/outlet committee stating the crop(s) and area to be irrigated. For preparation of nursery bed for monsoon and spring paddy, the main committee sets out the dates for irrigation availability at different reaches of the system and the users are expected to schedule the land preparation for nursery raising accordingly. For land preparation for transplanting and thereafter the users are required to submit their demand to the concerned branch/outlet committee. The branch/outlet committee functionaries compile the demand from all the users and prepare a demand list in a prescribed format of WUA submit to the main committee (see Box- 8). The users are required to have cleared all the dues (ISF, membership renewal) before submitting the demand.

Upon collection of irrigation demand from all the constituent branch/outlet committee, the secretary and *Karyadal* member of the main committee set out schedule

of water allocation in the branch/outlet canals by aggregating the demand of the users from each branch/outlet canal. The schedule thus developed from aggregated demand of the users, in prescribed format of WUA (see Box- 9), is communicated to the constituent branch/outlet committees through the member of the main committee *Karyadal* is also instructed for gate operation to regulate the supply accordingly. Within a branch/outlet however, it is the responsibility of the secretary of the concerned branch/outlet committee to set out allocation schedule and communicate the schedule to all concerned users.

Box- 8. Irrigation Demand Form

To.....

Subject: Irrigation Demand

Sir,

Kindly make available irrigation water for hrs Minute as stated hereunder

S.No.	Name of User	Branch / Outlet No.	Crop(s)	Area	Irrigation Need (Time/Frequency)	Remarks

Demand made by.....
 Date:

Approved by
 Designation
 Date:

Box-9. Irrigation Water Allocation Format

S.No.	Date	Branch/ Outlet No.	Area	Total Period of Irrigation		Crop	Remarks
				Beginning Date and Time	Closing Date and Time		

Secretary
 Date:

Chairman
 Date:

2.7.5 Irrigation Allocation Strategy

The main committee functionaries and the member of the *Karyadal* over time have gained experience in canal operation and working out irrigation schedule depending upon available supply in the main canal. They over time have also gained experience in working out irrigation duty in different reaches of the system and accounting the rainfall in developing and executing irrigation schedule.

The strategy currently practiced by the main committee in irrigation allocation is to keep all the branch canals and outlets open if the main canal flow at the intake be ≥ 1000 lit/sec. If the canal flow drops below this level, a rotational schedule is developed and executed by the main committee. The strategy in practice is to divide the service area of the system in two reaches if the main canal flow at the intake drops below 300 lit/sec and allocate irrigation on 3 days rotation in the two reaches.

2.7.6 Monitoring and Supervision of Irrigation Schedule

The WUA has evolved mechanism of monitoring and supervision of irrigation schedule in the constituent branch/outlet canals in the system. The secretary of the main committee and the main committee *Karyadal* are responsible for monitoring the irrigation schedule and assess whether or not the irrigation demand of the users in different branch/outlet canals have been met and whether or not there have been instances of misuse of irrigation water in any part of the system. The branch/outlet committee secretaries are responsible for communicating the main committee secretary or main committee *Karyadal* member about the adequacy or inadequacy of irrigation and about unauthorized irrigation use.

The assessment of irrigation schedule made by the secretary and main committee *Karyadal* is reviewed in the main committee meeting and if needed adjustments are made in the next turn of irrigation schedule.

2.8 Resource Mobilization

To be Developed

2.9 Record Keeping and Transpaency

To be Developed

3. Performance of Irrigation Management Transfer in Panchakanya Irrigation System

To be Developed

To be Developed

4. Summary, Conclusion and Policy Issues

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Annexes

ANNEX - I

List of Functionaries Elected at different Levels of WUA in the First Election

S.No	Branch Committee	Main Committee	General Assembly
Branch - 1			
1	Mr. Bhoj Raj Lamichhane - C	Mr. Chhanda Prasad Adhikari - C	
2	Mr. Indra Bilash Neupane - S	Mr. Rameshwar Mahato - VC	
3	Mr. Mukti Nath Ghimire - M	Mr. Bishnu Hari Devkota - S	
4	Mrs. Shanti Gautam - M	Mr. Kapil Mani Paudel - T	
Branch - 2			
1	Mr. Bishnu Regmi - C	Mr. Bhoj Raj Lamichhane - M	
2	Mr. Tika Ram Acharya - S	Mr. Bishnu Regmi - M	
3	Mr. Chakra Pani Adhikari - M	Mr. Jaleshwar Chaudhary - M	
4	Mr. Ishwary Lamichhane - M	Mr. Pat Ram Chaudhary - M	
5	Mr. Suresh Nath Regmi - M	Mr. Lila Nath mainali - M	
6	Mr. Ram Chandra Adhikari - M	Mr. Puskar Aryal - M	
7	Mr. Chhanda Prasad Adhikari - M	Mr. Hom Nath Regmi - M	
Branch - 3			
1	Mr. Jaleshwar Chaudhary - C	Mr. Shiva Shankar Paudel - M	
2	Mr. Hari Acharya - S	Mr. Gokarna Prasad Adhikari - M	
3	Mr. Gopal Raj Paudel - M		
4	Mr. Ram Krishna Chaudhary - M		
5	Mr. Khaga Raj Rimal - M		
Branch - 4			
1	Mr. Pat Ram Chaudhary - C		
2	Mr. Bashu Adhikari - S		
3	Mr. Nem Raj Paudel - M		
4	Mr. Rameshwar Mahato - M		
Branch - 5			
1	Mr. Lila Nath Mainali - C		
2	Mr. Laxman Lama - S		
3	Mr. Chandra Dutta Dhungana - M		
4	Mrs. Padma Kumari Shrestha - M		
5	Mr. Biga Mahato - M		
6	Mr. Ramesh Chaudhary - M		
Branch - 6			
1	Mr. Puskar Aryal - C		
2	Mr. Ram Prasad Timilsina - S		
3	Mr. Khaga Raj Paudel - M		
4	Mr. Bishnu Hari Devkota - M		

Branch - 7

- 1 Mr. Hom Nath Regmi - C
- 2 Mr. Tina Ram Paudel - S
- 3 Mr. Babu Ram Ghimire - M

Branch - 8

- 1 Mr. Shiva Shankar Paudel - C
- 2 Mr. Him raj Paudel - S
- 3 Mr. Nagishwar Acharya - M
- 4 Mr. Chet Badahur Pant - M
- 5 Mr. Kapil Mani Paudel - M

Branch - 9

- 1 Mr. Gokarna Prasad Adhikari - C
- 2 Mr. Rajendra Chaudhary - S
- 3 Mr. Madari Mahato - M
- 4 Mr. Jian Mahato - M
- 5 Mr. Chandra Dev Chaudhary - M
- 6 Mr. Prakash Chaudhary - M
- 7 Mr. Hari Narayan Chaudhary - M

ANNEX - II

List of Functionaries Elected at Different levels of WUA in the Second Term Election

S.No	Branch Committee	Main Committee	General Assembly
Branch - 1			
1	Mr. Bhoj Raj Lamichhane - C	Mr. Chhanda Prasad Adhikari - C	Mr. Indra Bilash Neupane
2	Mr. Shambhu Lal Shrestha - S	Mr. Rameshwar Mahato - VC	Mr. Raj Kumar Shrestha
3	Mr. Budhi Shingh Darai - M	Mr. Bishnu Hari Devkota - S	
4	Mr. Chandu Ram Chaudhary - M	Mr. Pushkar Aryal - T	
5	Mr. Kaladhar Ghimire - M		
Branch - 2			
1	Mr. Tika Ram Acharya - C		Mr. Chinta Mani Acharya
2	Mr. Indra Prasad Paudel - S		Mr. Chhanda Prasad Adhkari
3	Mr. Jannu Mahato - M		Mr. Chakra Pani Adhikari
4	Mrs. Min Kumari Paudel -M		
Branch -3			
1	Mr. Bishnu Ram Mahato - C		Mr. Pashu Ram Mahato
2	Mr. Gopal Raj Paudel - S		Mr. Shri Krishna Mahato
3	Mr. Ram kumar Mahato - M		Mr. Hari Prasad Sharma
4	Mr. Bandhu Ram Mahato - M		Mr. Khaga Raj Rimal
Branch - 4			
1	Mr. Bashu Dev Adhikari - C		Mr. Mahadev Aryal
2	Mr. Basanta Nath Regmi - S		Mr. Rameshwar Mahato
			Mr. Nem Raj Paudel
Branch - 5			
1	Mr. Lila Nath Mainali - C		Mr. Nathu Ram Mahato
2	Mr. Pitamber Thapalia - S		Mr. Ramesh Chaudhary
3	Mr. Setu Lal Lama - M		Mrs. Bhadia Tharuni
4	Mr. Dal Bahadur Mainali - M		Mr. Biga Mahato
5	Mr. Shyam Prasad Upadhyaya - M		
Branch - 6			
1	Mr. Ram Prasad Timilsina -C		Mr. Bishnu Hari Devkota
2	Mr. Shanta Acharya - S		Mr. Pushkar Aryal
3	Mr. Bhim Nidhi Dahal - M		
4	Mr. Kul Prasad Acharya - M		
5	Mr. Chandra Dutta Dhungana - M		

Branch - 7			
1	Mr. Hom Nath Regmi - C		Mr. Dil Bahadur Basnet
2	Mr. Janak Raj Paudel - S		
3	Mr. Khila Nath Dhungana - M		
4	Mr. Lok Bahadur Mainali - M		
5	Mr. Tirtha Bahadur Karki - M		
Branch - 8			
1	Mr. Lal Bahadur Shrestha - C		Mr. Chandra Prasad Pathak Mr. Danda Pani Ghimire Mr. Hasta Bahadur Basnet
2	Mr. Megh Nath Paudel - S		
3	Mr. Chandra Prasad Aryal - M		
4	Mr. Bashu Dev chapagain - M		
Branch - 9			
1	Mr. Chandu Ram Chaudhary - C		
2	Mr. Tika Ram Pathak - S		

Annex - III

List of Functionaries Elected at Different Levels of WUA in the Third Election.

S.No	Branch Committee	Main Committee	General Assembly
Branch - 1			
1	Mr. Ram Chandra Adhikari - C	Mr. Chhanda Prasad Adhikari - C	Mr. Suresh Nath Regmi Mr. Jian Mahato Mr. Gore Ram Mahato
2	Mr. Bhumi Sagar Adhikari - S	Mr. Chinta Mani Paudel - VC	
3	Mrs. Sushila Lamichhane - FM	Mr. Bishnu Hari Devkota - S	
4	Mr. Thidari Mahato - M	Mr. Bhoj Raj Lamichhane - M	
Branch -1 (Sub-Branch -2)		Mr. Ram Chandra Adhikari - M	
		Mr. Bashu Dev Adhikari - M	
		Mr. Sita Ram Mahato - M	
		Mr. Setu Lal Lama - M	
1	Mr. Kedar Nath Regmi - C	Mr. Shri Krishna Mahato - M	
2	Mrs. Man Kumari Paudel - FM	Mr. Kishor Dutta Mishra - M	
Branch - 1Kha		Mr. Tilak Prasad Paudel - M	
		Mr. Hom Nath Regmi - M	
1	Mr. Shree Krishna Mahato -C	Mr. Ram Hari Mainali - M	Mr. Dina Nath Upadhyaya Mr. Khaga Raj Rimal Mr. Gopal Raj Paudel Mr. Hari Prasad Sharma Mr. Chhannu Mahato
2	Mr. Magara Mahato - S	Mr. Budhi Prasad Pokharel - M	
3	Mrs. Mina Mahato - FM	Mr. Madari Raut - M	
Branch -1Kha, Sub-Branch - 3		Mrs. Sarita Paudel - M	
		Mr. Thakur Mainali -M*	
1	Mr. Dharma Raj Acharya - C		
2	Mr. Thaga Mani Mahato - S		
3	Mrs. Laxmi Chaudhary - Fm		
Branch - 1Kha, Sub-Branch - 4			
1	Mr. Pardeshi Mahato - C		
2	Mr. Ram Singh Mahato - S		
3	Mrs. Shanti Devi Dhungana - FM		
Branch - 1Kha, Sub-Branch - 5			
1	Mr. Bal Singh Mahato - C		
2	Mr. Ghorahi Mahato - S		
3	Mrs. Thagiya Mahato - FM		
Branch - 2			
1	Mr. Bashu Dev Adhikari - C		Mr. Chhanda Prasad Adhikari Mr. Rameshwar Mahato Mr. Madhav Prasad Aryal
2	Mr. Govinda Gautam - S		
3	Mrs. Sushila Adhikari - FM		
Branch - 2, Sub-Branch - 1			
1	Mr. Jian Mahato - C		
2	Mr. Bharat Mahato - S		
3	Mr. Thaguwa Mahato - M		
4	Mrs. Fohari Mahato - FM		

Branch -2, Sub- Branch - 2		
1	Mrs, Radha Devi Pokharel - C	
2	Mr. Shesh Kant Gautam - S	
3	Mrs. Purna Kala Paudel - FM	
Branch - 2, Sub-Branch - 3		
1	Mr. Baikuntha Bhandari - C	
2	Mrs. Sharda Rupakheti - FM	
Branch - 3		
1	Mr. Setu Lal Lama - C	Mr. Bhulan Chaudhary
2	Mr. Krishna Prasad Shrestha - S	Mr. Biga Mahato
3	Mr. Bhumishwori Upadhayaya - M	Mr. Sanu Thidari mahato
Branch - 3, Sub-Branch - 1		
1	Mrs. Sita Kumari Mahato - C	
2	Mrs. Sabita Chaudhary - FM	
Branch - 3, Sub-Branch - 3		
1	Mr. Jibhan Mahato - C	
Branch - 4		
1	Mr. Sita Ram Mahato - C	Mr. Nathu Ram Chaudhary
2	Mr. Krishna Bahadur Lama - S	
3	Mrs, Somati Lama - FM	
Branch - 4, Sub-Branch - 1		
1	Mrs, Sumitra Mahato - FM	
Branch - 4, Sub- Branch - 2		
1	Mrs. Siyani Lama - FM	
Branch - 4, Sub-Branch - 3		
1	Mrs. Padma Kumari Shrestha - FM	
Branch - 5		
1	Mr. Ram Hari Mainali - C	Mr. Bishnu Hari Devkaota
2	Mr. Raj Saran Neupane - S	Mr. Chhappan Bahadur Tamang
3	Mrs. Shanta Acharya - FM	Mr. Babu Ram Mahato
		Mr. Babu Ram Ghimire
		Mr. Hom Nath Regmi

	Branch - 5, Sub-Branch - 1		
1	Mr. Dil Bahadur Basnet - C		
2	Mrs. Chet kumari Pathak - Fm		
	Branch - 5, Sub-Branch - 2		
1	Mr. Lila Nath mainali - C		
2	Mrs. Sashikala Dhungana - FM		
	Branch - 5, Sub-Branch - 3		
1	Mr. Mahendra Prasad Dahal - C		
2	Mrs. Chandrika Basnet - FM		
	Branch - 5, Sub-Branch - 4		
1	Mr. Hasta Bahadur Basnet - C		
2	Mrs. Manju Kumari Mainali - FM		
	Branch - 5, Sub-branch - 5		
1	Mr. Nanda Lal Paudel - C		
2	Mrs. Sarita Paudel - FM		
	Branch - 6		
1	Mr. Budhi Prasad Pokharel - C		Mr. Lal Bahadur Shrestha
2	Mr. Kapil Mani Paudel - S		Mr. Chandra Prasad Aryal
3	Mrs. Man Kumari Thapalia - FM		Mr. Ram Din Chaudhary
	Branch - 6, Sub-Branch - 1		Mr. Chandra Prasad Pathak
1	Mr. Kalu Mahato - C		
2	Mrs. Parbati Chapagain - FM		
	Branch - 6, Sub-Branch - 2		
1	Mr. Kamalapati Paudel - C		
2	Mr. Devi Dutta Acharya - M		
3	Mrs. Akshara Paudel - FM		
	Branch - 6, Sub-Branch - 3		
1	Mr. Narayan Dutta Upadhayaya -C		
2	Mrs. Parbati Paudel - FM		
	Branch - 6, Sub-Branch - 4		
1	Mrs. Ganga Maya Regmi - FM		

Branch - 6, Sub-Branch - 5		
1	Mr. Durga Dutta Acharya - C	
2	Mrs. Kapuri Paudel - FM	
Branch - 6, Sub-Branch - 6		
1	Mr. Chhabilal Giri - C	
2	Mrs. Sarswati Regmi - FM	
Branch - 7		
1	Mr. Madari Raut - C	Mr. Ram Kumar Chaudhary Mr. Gudar Mahato.
2	Mr. Dukhat Mahato - S	
Branch - 7, Sub-Branch - 1		
1	Mr. Ram Krishna Raut - C	
2	Mr. Mangara Mahato - S	
3	Mrs. Nati Chaudhary - FM	
Branch - 7, Sub-Branch - 2		
1	Mr. Balram Chaudhary - C	
2	Mrs. Jiyani Raut Tharuni - FM	
Branch - 8		
1	Mr. Tilak Raj Paudel - C	Mr. Chinta Mani Paudel Mr. Ek Narayan Paudel Mr. Jin Bahadur Rimal
2	Mr. Chakrapani Wagle - S	
3	Mr. Dinesh Adhikari - M	
4	Mr. Balram Giri - M	
5	Mrs. Laxmi Devi Paudel - FM	
Branch - 8, Sub-Branch - 1		
1	Mr. Ram Krishna Upadhyay - C	
2	Mr. Durga Dutta Paudel - S	
3	Mr. Chandra Dev Chaudhary - M	
4	Mr. Chhakeel Mahato - M	
5	Mrs. Binda Kumari Paudel - FM	
Branch - 8, Sub-Branch - 2		
1	Mr. Khom Nath Paudel - C	
2	Mr. Dinesh Bahadur Rimal - S	
3	Mrs. Murali Devi Rimal - FM	
Branch - 8, Sub-Branch - 3		
1	Mr. Krishna Dutta Paudel - C	
2	Mr. Vikram Mahato - S	
3	Mr. Gauri Ram Mahato - M	
4	Mrs. Binita Paudel - FM	

<p style="text-align: center;">Outlet - 1</p> <p>1 Mr. Bhoj Raj Lamichhane - C 2 Mr. Shukhdev Ghimire - S 3 Mr. Raj Kumar Shrestha - M 4 Mr. Purna Bahadur Koirala - M 5 Mrs. Shiv Maya Dawadi - FM</p>		<p style="text-align: center;">Outlet - 1,2</p> <p>Mr. Madhu Bilas Neupane Mr. Bhanu Bhakta Ghimire</p>
<p style="text-align: center;">Outlet - 2</p> <p>1 Mr. Indra Bilash Neupane - C 2 Mr. Krishna Bahadur Thapa - S 3 Mr. Mangal Lal Shrestha - M 4 Mrs. Putali Maya Ghimire - FM</p>		
<p style="text-align: center;">Outlet - 3</p> <p>1 Mr. Lal Bahadur Gurung - C 2 Mr. Budhi Sagar Darai - S 3 Mr. Nathu Ram Darai - M 4 Mr. Magara Darai - M 5 Mrs. Gargara Mahato - FM</p>		
<p style="text-align: center;">Outlet - 4</p> <p>1 Mr. Balbhadra Ghimire - C 2 Mr. Mukti Nath Neupane - M 3 Mrs. Chandra Kala Ghimire - FM</p>		<p style="text-align: center;">Outlet - 4,5</p> <p>Mr. Chuda Mani Adhikari</p>
<p style="text-align: center;">Outlet - 6</p> <p>1 Mr. Ishwar Dutta Mishhra - C 2 Mr. Jalu Mahato -S 3 Mr. Yasara Mahato - M 4 Mr. Bachchu Chaudhary - M 5 Mrs. Hemanti Chaudhary - FM</p>		
<p style="text-align: center;">Outlet - 8</p> <p>1 Mr. Punya Prasad Adhikari - S 2 Mrs. Renu Adhikari - FM</p>		
<p style="text-align: center;">Outlet - 9</p> <p>1 Mr. Chhannu Mahato - C 2 Mr. Ganga Ram Mahato - S 3 Mrs. Kanani Mahato -FM</p>		<p style="text-align: center;">Outlet -9</p> <p>Mr. Gokama Prasad Adhikari</p> <p style="text-align: center;">Outlet - 10</p> <p>Mr. Tika Ram Pathak</p>

* = Karya Dal (Ex- officio Member of Main Committee)

C = Chairman, VC = Vice - Chairman, S = Secretary, M = Member, FM = Female member.