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EVALUATING THE EFFECTIVENESS OF INVESTMENT IN IRRIGATION MANAGEMENT TRANSFER PROJECT

(FINAL REPORT)

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Team Leader

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ABBREVIATIONS AND ACRONYMS

IMTP	Irrigation Management Transfer Project
WUA	Water Users Association
NPCS	National Planning Commission Secretariat
CMED	Central Monitoring and Evaluation Division
DOI	Department of Irrigation
MOWR	Ministry of Water Resources
HMGN	His Majesty's Government of Nepal
IMD	Irrigation Management Division
PRA	Participatory Rapid Appraisal
PIS	Panchakanya Irrigation System
KIS	Khageri Irrigation System
NWGIS	Nepal West Gandak Irrigation System
AMIS	Agency Managed Irrigation System
FMIS	Farmer Managed irrigation System
ADB	Asian Development Bank
ADBN	Agricultural Development Bank of Nepal
DWRC	District Water Resource Committee
BC	Branch Committee
MC	Main Committee
DADO	District Agricultural Development Office
DAP	Di-Ammonium Phosphate
EIRR	Economic Internal Rate of Return
NPV	Net Present Value

EXECUTIVE SUMMARY

1. This study was undertaken with an objective to assist NPC in judging the imapcts of investment of the Irrigation Management Transfer Project activities in three sites of first phase viz. Panchakanya Irrigation System (PIS), Khageri Irrigation System (KIS) and Nepal Western Gandak Canal Irrigation System (NWGCIS). The study involved a multi-disciplinary team comprising of engineers, agri-economist and sociologist. The field activities were performed between May and June of 2003. The study methodology consisted of physical walkthrough in the system, participatory rapid appraisal, household sample survey and interview with key informants both of the agency as well as the water users associations of the studied irrigation systems. The study specifically focuses on examining the current physical, agricultural, socio-economic and institutional status of the three systems. The analyses were focused to evaluate the increase in crop yield, cropping intensity, income and EIRR of the investment. The study has looked into the benefits of intervention. Benefits as being conceptualized were the water availability and distribution, operation and maintenance situation, resource mobilization and conflict resolution, crop production and productivity as well as farm income.

Panchakanya Irrigation System

2. The study revealed that about 72 percent of the 600 ha of command area in PIS system were receiving irrigation during normal paddy season before turn-over and the reasons were profuse water leakage along the canal conveyance system as well as poor water management practice. In winter season it was reported to be about 33 percent and while that in spring season to be about 17 percent. The tail-end branches such as BC- 7 and BC- 8 were not receiving water at all during winter and spring seasons. It is learned during recent PRA that entire command area measuring about 600 ha of land were provided with irrigation facility for the rice crop last monsoon season. The WUA executives explained that it was possible because of water saving from leakage along canals after accomplishing the repair/maintenance works under system improvement program as well as improved water distribution system adopted by the WUA. The WUA also reported that the farmers the tail-end branch BC- 8 got water for the first time for their rice crop in 1998. The water delivery and distribution in spring season also has improved and the testimony to this fact is the increasing spring rice (chaite dhan) cultivation in the command area. Despite the improvement in terms of water availability, the system hasn't been able to supply adequate irrigation water. This is mainly due to the limiting water availability at source. It was reported that water at source is in diminishing trend due to encroachment at the catchment area of the source near its intake. Due to the reduced water availability the irrigated area in the dry season has been observed to decrease from 200 ha in 1995 to 120 ha in 2001/2002.

3. The physical improvements made during the IMTP intervention were found to be in good shape. Farmers have expressed their satisfaction over the quality of construction

and the transparency maintained during the construction of physical facilities in the system. Farmers were themselves involved in quality control of the construction works. On the other hand they still feel that the system wasn't completely improved in terms of physical facilities at the time of its hand over to the users.

4. It is found that the establishment of O&M plan which was developed by the IMD staff earlier along with the IMTP consultants for the WUA has helped the WUA in scheduling the available water. There are documents with needed field information along with guidance on personnel requirement to perform the tasks. The establishment of Canal Management Workforce, wherein the personnel are identified who would perform the task of O&M in their respective branch or sub-branch, has also helped the WUA and farmers in managing the O&M aspects. There are gauge sticks along the canal system for water discharge measurement. Based on the information gathered from PRAs and household survey information, there has been marked improvement in water schedule development and implementation. The farmers are satisfied with the prevailing system of water distribution. In order to compensate the comparatively lower discharge available for tail reach farmers, there exists a differential time allotment. For example, the water allocation schedule at the rate of 9 minute per katha at head reach and 12 minutes per katha at tail reach was being observed at some periods. The cultivation of spring paddy has attracted the farmers here. However, the scarce water available has been the cause for concern. For that reason, the WUA has to put much effort during the water distribution for this crop. It was revealed that, at times, the schedule for water distribution went as wide as 15 days apart so that the standing crop could be saved from drop failure due to drought. The WUA has mandated the farmers to get approval in advance from WUA so that the latter can come up with possible water scheduling.

5. The study however reveals that the tail reach farmers still face problem of water stealing and breaching of canals. For example, in the BC 1, the tail reach farmers have to watch constantly the upper reaches to get water in their fields even during their turns. When it comes to water allocation in rotation at different branches along main canal, there is no problem occurred, but within branches and sub-branches, where there are no specific person to watch the water application during the turn as decided, the farmers themselves sometimes, steal other's turn. At the time of water scarcity, even when the WUA puts forward a tight water distribution schedule, there do exist some amount of problems at field level.

6. The household survey as well as PRA sessions in this system revealed that almost all the respondents replied that there has been conspicuous improvement in the physical state of the canal system. There has been decrease in leakage and seepage from the canal from more than 50 percent to some 25-30 percent now. After the transfer of management, the WUA and farmers as well seemed to be more aware of the state of canal. Now the maintenance activities are more prompt and more frequent. Perhaps the rule to deposit certain amount for maintenance in advance with the main committee is instrumental in

generating this awareness. Farmers get refunding at the rate of Rs 100 per day for their labor contribution.

7. The yield of monsoon paddy is also reported to have slightly risen after improved water distribution arrangement during the initial years of IMTP. Farmers get a yield of 3.5 t/ha for masuli and savitri varieties, which are grown during monsoon season. The yield of monsoon paddy has been found slightly decreased comparing to the yield in 1995. It is reported that there has not been improvement in productivity of other crops except wheat. The average yield of maize in summer is around 1 t/ha.

8. The cropping intensity is recorded as 235 percent for head reach of the canal. Similarly, the intensity is recorded as 210 and 172 percent for middle and tail reaches respectively based on household surveys. The overall intensity for PIS command area is calculated as 205 percent. . The cropping intensity has increased only by 5% after the IMTP. These figures aren't bigger as compared to that obtained during baseline study earlier the transfer program.

9. It is to be understood however that the crop yield is the output of quality seeds, optimum use of inputs (chemical fertilizer, irrigation) and timely farming practices. In some cases the crop yield has gone down due excess soil moisture. Water logging condition prevailed in low land areas. In tail portion of PIS (Ward No 7) the soil is mostly the clay mixed, which clots when water dries, reducing the aeration in root zone eventually declining the crop productivity.

10. The crop yield reported is relative higher for paddy, wheat and potato, which have maintained the level of 3-4 years ago. It is understood that the farmers have their own way of selecting seeds for the next year. For maize crop the yield level is rather low as compared to the farmers' experience of 3-4 years ago. In maize it is rather difficult to accurately measure the output as they are consumed as green cobs in the area.

11. Most of the farmers in PIS command area are found to be aware of chemical fertilizer and improved seeds, but they haven't used insecticides and pesticides. Farmers reported that the use of compost fertilizer (green manure) has significantly reduced over the years and hence they have gone for higher dose of urea in late and early paddy. Almost all the sample farmers reported to have applied urea in paddy and wheat crops. However, only 60 percent reported the use of DAP and still lesser was the application of potash. The survey and the focus group discussion of the farmers revealed that there has been significant increase of about 15% in application of chemical fertilizers after the IMTP. The application of urea and DAP is higher than the recommended dose. Despite the increase in the application of chemical fertilizers no significant change in the yields of the major crops are observed. The reduction in the yield of major crops over the years is also attributed mainly to the reduced supply of water in quantity over the years and also to the reduced application of green manure

12. Based on the finding of the household survey, it is found that the majority of the households are selling agricultural products such as lentil and paddy. Livestock i.e.

selling of milk is another components which has a fair share in household income. The farmers themselves consume most of the agricultural products. Slightly less than quarter of the income (22.8%) of farmers in the command area is derived from agricultural related jobs.

13. The net return per hectare for monsoon paddy under irrigated condition is calculated to be Rs. 7856.0. The crop variety under consideration was Masuli, which is grown by majority of the farmers in the common area of PIS. Benefit in early paddy is higher because of higher yield of early paddy (Rs 10639). Spring Maize fetches higher profit compared to other crops as spring Maize is sold as green cobb which draws higher price with the net return is Rs 6590.0 per ha.

14. Membership of WUA is a must to all the beneficiaries for having water right and to be an eligible voter and candidate of WUA executive committees. There are 898 members and there are 10212 numbers of shares for 335.18 ha of land areas which means the membership and share certificate acquisition are accomplished in the magnitude of 90 to 95 percent. It was also reported that not all the irrigation users have taken the share certificate. Also among the users who have taken share, their share holding isn't as per their land holding. Hence, all the area under irrigation hasn't fallen into the share distribution in PIS.

15. The net incremental benefit of crop cultivation after IMTP is higher by NRs 457,420 comparing to that before IMTP. Given the total investment (physical improvement and institutional development) made in PIS of NRs. 7,924,727.0, the return seems not much significant. The EIRR of the investment comes out to be 1.5%, which is far below the expected EIRR from the IMTP intervention. One of the major reasons for such low return on investment is the increase in cost of production of major crops. There haven't been much change in yield and cropped area of major crops except for late paddy which has increased cropped area by 15%. The cropped areas of winter crops and oilseed have significantly reduced after IMTP. Due to the water scarcity in spring season the cropped area for early paddy and spring maize hasn't increased despite the canal system was physically improved. The results clearly show that agriculture and its economy haven't improved much even after the investment in the system has been made.

16. The WUA has access to various financial resources viz. membership fee, share distribution fee, irrigation service fee (ISF) and others. The membership fee of Rs 10 per year is levied. The share distribution fee is charged at the rate of Rs 30 per ha (Rs 1 per katha). The ISF for monsoon paddy & spring paddy is Rs 150 per ha (Rs 100 per bigha) and Rs 75 per ha for wheat or maize (Rs 50 per bigha), Labor fee of Rs 300 per ha (Rs 200 per bigha) are charged.

17. Given the physical characteristics of the system the amount of ISF collected should be enough to meet the normal operation and maintenance cost of the system. It has been reported that the ISF collection and collection of other fees have been quite irregular after 1999(2055/56). It was reported that progress in the collection of ISF fee and other

fees was reported to be as high as 90% during the period when the system was handed over to the users. The WUA is having some difficulty in collecting the ISF. WUA of PIS feels that it doesn't have enough authority to increase the ISF collection rate. The WUA demands that unless the government brings a new law attaching the ISF with other fees, it is not possible to increase the collection efficiency.

18. From the PRA and household survey result, it is found that the conflict occurrence has decreased after the transfer of management. The main reason being the better water distribution system and the ownership feeling among the water users. There are however reports of water stealing incidents specifically during spring and winter seasons, but those were sporadic and minor incidents some of which were solved at farmers level while some of them needed intervention by the WUA chairman of secretary.

Khageri Irrigation System

19. Based on the information gathered from PRAs and household survey information, there has been some improvement in water schedule development and implementation specifically in main canal. The field study reveals that along the branches, the water distribution has still to be improved and WUA is trying in that aspect. The water distribution among the different branches from the main canal is done on rotation basis. The entire main canal length is divided into three chunks for weekly water allocation in rotation during the monsoon paddy cultivation time. In spring season, the water is distribution for spring paddy at Branch 1 area only. In the branch and sub-branch systems, the corresponding WUAs develop the water distribution system on their own. The schedule and time allotment is changed as and when necessary.

20. The physical improvement works carried out during IMTP intervention are relatively in good shape and condition. Most of the farmers were happy over the quality of construction. Some of important physical improvement works such as repair of outlets and regulating structures were not carried out because of the resource constraints. These shortcomings have restricted the physical performance of the system.

21. The household survey indicated the maintenance of canals, specifically the branch and tertiary canals, have improved after the turnover. The respondents informed that the maintenance activities are swift now. The regular maintenance activities are done two to three times a year. The general feeling that now the farmers and the committees have to do this job now. It is found that the branch committees raise certain amount from its water users for maintenance expenses also. However, there is a lack of uniformity or a certain basis of charging for that matter.

22. Crop like paddy, what, maize, lentil and mustard are commonly grown crops in KIS area. About 85 percent of paddy area is covered by Masuli variety and the rest is occupied by the varieties like Jhapali, Sabitri, Amjhupe. Sabitri variety is getting popular in improved varieties after masuli in the command area. In wheat NL 251 and NL 297 are grown by the majority of the farmers. Rampur yellow in maize and CH045 in early rice are the common varieties included by the farmers in crop sequence for spring season.

23. Paddy-wheat-maize, paddy-wheat, paddy-lentil, paddy-mustard are the dominant patterns followed in KIS area. Khageri irrigation System was developed to provide supplementary irrigation to the monsoon paddy. Some farmers have included early rice in the crop sequence, however the area coverage under such pattern is limited. In some areas, peas are also included in the crop rotation. KIS has more or less similar cropping patterns to that of PIS, except that spring maize crop is grown relatively in larger area. Limited water supply at source is a limiting factor for enhanced agricultural production in the command area of the system.

24. The overall cropping intensity is calculated to be 213 percent in KIS command area. The cropping intensity has increased by just 9% after the IMTP. It is apparent that the farmers at the tail reach engage more in farming during non-monsoon seasons as compared to the same in the upper reaches. The cultivation of maize is quite prevalent here. Although less water is available at the tail portion, the farmers grow non-rice crops thus contributing to higher crop intensity.

25. Due to timely availability of irrigation in the head and middle reaches of KIS, the yields of paddy and wheat are considered normal. However, area planted to paddy is relatively less and yields too are not impressive due to one-month delay in water supply in tail portion. Lentil and mustard crops showed diminishing crop productivity for the last few years as reported by the respondents farmers. The reasons given for decreased crop yield are again deterioration in seeds quality and excess moisture in the soil.

26. All the respondents of KIS, reported that they have used Urea mainly in paddy, wheat, mustard and potato. Some 25 percent of samples reported that they have put DAP also. Some of the respondents, reported to have applied potash but in lesser quantity. The respondents were found to be using the recommended fertilizer dose of urea but half of the recommended dose of DAP and potash

27. Paddy, maize, lentil, pea and milk are the major farm produces the farmers sold in the market. The markets are in and around the KIS command area including Shivnagar, Gitanagar, Jagatpur, Rampur and Narayanghat.

28. Similar to the PIS, based on the finding of the household survey, it is found that the majority of the households are selling agricultural products. Livestock is another components which has a fair share in household income. The farmers themselves consume most of the agricultural products. More than 25% of the income (28.4%) of farmers in the command area is derived from agricultural related jobs. The late paddy and spring paddy brings the first (NRs 11224.0) and second (NRs. 9538.0) highest net profit followed by lentil and spring maize. It is to be noted that green cobs has good market in Chitwan resulting in additional cash income. The performance of wheat crop was not so impressive during last winter due to excess moisture in the soil as reported by the farmers. There were several cases of late plantation for the same reason.

29. The net benefit of crop cultivation per year after IMTP is higher by NRs . 1,156,676.0 comparing to that before IMTP. Given the total investment (physical improvement and

institutional development) made in KIS of NRs 32,978,165, the return seems not much significant. The EIRR of the investment has been found to be negative. Such negative return on investment is mainly due to the increase in cost of production of major crops. KIS being irrigation system only for monsoon paddy, the physical improvements couldn't fetch significant agricultural and economic return.

30. The system is under joint management in which the main canal is managed jointly by WUA and DOI and the branch canal system is operated and maintained completely by the WUA. The WUA contributes 15% of the cost of maintenance of main canal system. This arrangement of management seems to be working well in terms of sustainable O&M of the system.

31. Like in PIS, the membership of WUA is a must to all the beneficiaries for having water right and to be an eligible voter and candidate of WUA executive committees. The membership of WUA is called the share membership and distributed to the farmers on the basis of household. For acquiring the share certificate, the water users are required to pay at the rate of Rs 30 per ha (or Rs 1 per katha. It is learnt that the general assembly is considering the new rate of share certificate distribution fee. As of now, there is not much effort going on to collect the share distribution fee. The accomplishment is in the range of 31 to 92 percent. Not all the branch committees have evolved as capable institution to take over the management responsibility of the canal system.

32. The ISF rate is Rs 60 per ha which would mean that about Rs 170760 of annual ISF is targeted for actual irrigated areas of say, 2846 ha of land. The ISF collection being done for the last four years is just around 33 to 40 percent of the targeted amount. It is learnt that Rs 85380 has been collected so far as membership fee by June 2002 which is about 34% of the targeted amount. The ISF is being collected at the branch or sub-branch level. They retain some amount needed for the maintenance and rest is being sent to the main committee. The main committee is using the collected fund for various other development activities such as purchase of seeds, fertilizers to be distributed among the farmers of the command area.

33. The PRA and household survey finding indicate that the conflict occurrence has decreased somewhat after the transfer of management. The main reasons being comparatively improved water distribution system and the fact that now the farmers and WUA for that matter have to solve their problem by themselves. Though the WUA in KIS hasn't developed up to its full capability, it is apparent that it is in the process of evolution. The recently held general assembly of branch and main committees have shown a very positive response regarding the ownership feeling of the Khageri Irrigation System.

34. It is evident that the capability and understanding of WUA executives have been increased over the period with the increased exposure to various training programs, discussions, meetings and visit programs. Their capabilities in institutional development, operation and maintenance of irrigation system account keeping and several other issues

are apparent. Efforts put forward by the WUA in activities such as repair/maintenance, water distribution scheduling and the collection of ISF, membership fee and share certificate fee are encouraging. The general assembly held has further ratified a resolution wherein it is mentioned that the main canal also should be taken over from the department of irrigation. Their concern for sustainable management of O&M activities as well as resource generation should be viewed as an indicator of institutional growing.

45. Some problems identified are (I) WUA executives voice that there should be some legal authority bestowed upon the organization so that they can administer the resource mobilization as well as the reinforcement of promulgated rules and regulations by the WUA (ii) Low discharge during less rainfall and during non-monsoon season (iii) Lack of communication between the main committee and lower tier water users groups and then the common farmers and iv) low agricultural production and low economic return from the agriculture has affected the WUA's institutional strength and also provided less incentive for the farmers to actively participate and contribute in the management of the system.

Nepal West Gandak Canal Irrigation System

46. In NWGCIS, due to active participation of WUA, it has been successful to pursue the Indian authority controlling the barrage gate operation, to maintain water at 365 m mark, and such arrangement has resulted in acquiring agreed-upon discharge in the canal.

47. NWGIS is bestowed with some of the serious physical and environmental problems like damages caused by floods in the local drain and submergence of command area due to floods. Another major problem is that heavily silt laden water causes the siltation in the main and branch canals affecting the conveyance capacity of the canal system and also demanding large amount for desiltation. The main canal of NWGIS was found silted up reducing the conveyance capacity of the canal. Mainly desiltation works were carried out during the IMTP intervention in addition to construction some crucially important structures. Regarding the quality of construction, farmers do have mixed feelings. In general they aren't happy over the way construction activities were carried out. Main cause of their resentment is the lack of transparency in implementation of construction works.

48. The water at the intake should be sufficient to irrigate the command area of the system in all seasons. But poor physical condition of the canal and inadequate operation and maintenance of the system has caused disparity in terms of irrigation among the head and tail reaches. It is observed that some farmers, who grow vegetables, have installed the shallow tube-wells considering the unreliable management of water. Spring crops are not found in the command area except sugarcane, because canal is closed for maintenance.

49. Main Canal and its control structures are operated by the CMWF appointed by the WUA main committee. Likewise, all branches, minors and MC/MFDs are also supposed to be operated by the assigned CMWF. But, it is not happening actually. In most of the cases, water entered in the branch and minor canals flows spontaneously. Farmers who need

water operate the gates and control structures and irrigates the farm all on their own. In very few cases, the CMWF have operated the branch and minor canals.

50. Speaking of maintenance, the desilting works, the maintenance of service road and the essential structure maintenance were done by WUA executive committee. The head of the technical section of Executive committee with project overseer conducted jointly walk-through of main canal with the assistance of CMWF members. the identified works were measured and estimated. After that executive Committee member has carried out th work with the assistance of CMWF and office secretary following the working processes. Some Rs 439,229, was spent for such maintenance works of which WUA and rest of Rs 375079 shared Rs 64150 was born by the project fund.

51. Canal operation Plan (COP) was developed during IMTP implementation period. Accordingly Canal Management Work Force (CMWF) was established in every tier of canal of the irrigation system. Because of the defunct status of WUA, all the arrangements made for O&M of the system isn't visible in the system at present. However, it was found that the prepared COP has not been implemented in the field. Because of the poor operation and maintenance, the water availability and reliability of supply has been severely affected in NWGIS.

52. Water distribution system in the head reach is quite institutionalized. Within the branch & its field channels, rotation system has been established. The entire branch canals' command area is divided into three parts, and rotation is observed on the basis of area to be irrigated. Within farm ditches, farmers themselves with their Upa-toli committee prepare a rotation plan and water is distributed. Most of the area of head reaches remains wet due to the seepage from both canal systems viz Nepal Gandak and Indian Western Canal. Water distribution system in the middle and tail reach is not found so systematic. Rotation or any schedule is not maintained. Water within the branch is distributed freely. There is not any specific rule or regulation for distribution of water. Water users report that there is no reliability of water in the middle reach, while in tail reach, farmers complain water being not available easily for them.

53. The household survey complained that the maintenance of main canal has not been done well enough after the turnover. The repair and maintenance works are not done as regularly and as needed at the main canal. But there is a clear signal that the repair maintenance works at branch and tertiary level have gained more systematic and equitable approach especially at the head reaches.

54. Main crops are paddy, wheat, maize, lentil, peas, mustard and sugarcane. In addition, vegetables are seen in a small area. Sugarcane is estimated to occupy about 25% percent of cultivated area in the command area. The cropping pattern in the command area is decided by availability of irrigation water, soil type and demand of crops in the markets. Majority of the farmers (80%) have grown two crops a year. Paddy-wheat and paddy-lentil+mustard are the common patterns followed in the area. In the areas with tube well facility, the farmers (2%) have grown three crops a year, namely paddy-wheat-maize and

paddy-wheat-vegetables. The paddy and wheat crops have shown satisfactory level of crop yields this year as compared to previous years. The overall cropping intensity is 187 percent.

55. Almost all the respondent farmers reported to have used Urea, whole 80 percent applied DAP and three percent did so for Potash. Mainly paddy, wheat and mustard have received chemical fertilizer. The farmers reported that chemical fertilizer was not available in time and in adequate quantity. Usually the chemical fertilizer was not available in time and in adequate quantity. Usually the farmers bought the chemical fertilizer from India though they think that the chemical fertilizer brought from India is relatively of low quality.

56. Paddy, wheat, mustard are the major commodities traded by the farmers in the area. Based on the finding of the household survey, it is found that the majority of the households are selling agricultural products. Livestock is contributing a very little in household income. About 72 percent of the income of farmers in the command area of NWGCIS is derived from agricultural sector.

57. The crop budget analysis indicates a high net profit (Rs 11846) in the sugarcane farming. The average return for monsoon paddy is estimated at Rs 7391. Lentil crop reported to have produced lower yields last year. It is to be noted that farmers are increasingly attracted to the vegetable farming, which provide highest net return, but its coverage isn't significant. Also the fact that those who have cultivated the vegetables basically rely on ground water for irrigation due to poor reliability of supply of surface water.

58. The record of membership up to this date is 5935 households out of 10159 households in NWGCIS which accounts for 58% and 1106 households out of 1459 households in Piparpati Parsauni which accounts for 76% of the water users of the system.

59. In terms of ISF collection the efficiency of collection is 48%. This reflects the weakness on the part of institution to generate resource for O&M of the system. Many irregularities were observed in the context of ISF collection.. In fact, some persons were appointed to do this job on salary basis. Many did not give the full account of money being raised. Although bank accounts are opened for that purpose, but there were numerous cases of delinquencies in this aspect. Since 1999, the main committee had taken over the responsibility of ISF collection. The records show that there is no amount collected as ISF since 1999/2000 till date. The reason is said to be the defunct state of WUA. If there is major breaching in the canal, the branch committee requests to the project for equipment and manages the fuel from the fund of the committee for that work. Records of the maintenance activities are maintained properly in main committee however it is not found accordingly in the Branch and main canals.

60. In NWGCIS, there are other financial sources such as road tax, forest resources and land revenue.. The amount collected as market tax up to August 1999 is Rs 38000. Since 1999 no actions have been taken to generate resources from other sources as well.

61. In the case branches, minors MC/MFDs along head reach area maintenance activities are undertaken on equitable basis. The whole canal is measured and divided to all the farmers on the basis of their land holding size. The length of canal to be desilted is shared at the rate of 25-35 feet per Bigha. Farmers complete their job before the canal operation season begins. However, in middle and tail reach portion such organized system is not yet seen. Farmers on their own undertake desilting works as per need and interest.

62. Capacity of the WUA can be viewed as technical and managerial considering the nature of works that are to be performed. There have had been a number of training programs wherein the WUA executives and other technical group members such as Canal Management Wok Force were trained on both management as well as operational and maintenance tasks. Despite the trainings had increased some awareness among the users and WUA, there wasn't sustainability in terms of maintaining the institutional capability of WUA. In other words, say, rules and procedures are established, but there has been very weak implementation in the field.

63. In the case of lower tiers organizational as well as operation and maintenance capability seem relatively stronger and that has been found institutionalized in head reach. But in the middle and tail end position this capacity has been found relatively weak. These are more organizational/institutional problems among the members of the committee. There seems lack of good leadership and process of developing consensus..

64. The problems identified regarding the institutional weakness of the system as as; (I) Strong feeling of political groups among farmers even among the functionaries of WUA. (ii) Lack of communication between the UA main committee functionaries and the lower tier committee and general farmers (iii) Poor water management practices specially along mid and tail reaches of the system.

65. Overall findings of the study can be summarized as following:

(i) It is apparent that the respective WUAs and the farmers in general seemed to have shown growing concerned about the amount of discharge available at the source in all three turned-over systems. Invariably in all three systems, the WUA main committee seemed much eager to augment the available flow at the source through all possible means. For example, the WUA of PIS is voicing about the need of conserving water/spring at the source. They are thinking of lining the canal system as much as possible with the available financial resource that they have, in order to decrease the seepage and conveyance losses. The concern of WUA in KIS is also very much concerned about the low water availability at the source of the system. Despite the water is abundantly available at source in NWGIS, the farmers aren't getting better irrigation services due to poor operation and maintenance of the system. There are reasons to believe that the actual irrigated areas in all seasons have improved after the turnover in all three

systems. This development could be attributed to the improved water availability and planned water distribution schedule developed by the respective WUAs.

(ii) It is evident that the cultivation of spring paddy had increased in PIS during the initial years of IMTP. It was observed that the crop area for spring season is gradually diminishing in PIS. Despite the improvement the there have been no significant increases in crop yield of major crops.

(iii) In PIS, the water distribution from the main canal to branches is certainly improved. However, there still remains some conflicts at the individual branches specially at the tail portions as no specific personnel is there to supervise the planned water distribution schedules. In KIS also, the case is similar. Some efforts have to be exerted in streamlining the water distribution activities along branches and minors. In NWGIS, the case is different. The recent situation revealed that due to unsatisfactory working of main committee, the water distribution from the main canal to the branches and minors is irregular. This is also because of poor repair/maintenance activities. But within branches and minors, the water distribution systems are better established.

(iv) Although it is evident that the canal systems have had much renovation just prior to turnover, for that reason also, the canal system seemed in better shape specially the PIS. Since the KIS and the NWGCIS are bigger systems and also because of considerable damage by floods, there are several places to be found out where repair/maintenance activities are needed right away.

(v) The economic analysis on investment in PIS revealed that the EIRR on investment is meager 1.5%. In case of KIS, the incremental benefit on agriculture after IMTP is NRs 11,56,676.0 but the EIRR value is negative. In case of NWGIS the economic evaluation revealed that the net benefit from agriculture was far better prior to IMTP that after the handover of the system. For NWGIS the net present value of investment in the base year is higher by more than 30 million a year compared to net present value of the benefit agriculture. The reason for such low return on investment is the insignificant improvement in agricultural production even after the systems were physically improved and increase in cost of production of major crops over the years

(vi) It is evident that the institutional strengthening process and procedures of IMTP have had very direct impacts mainly in two sites; PIS and KIS. There has been much mobilization of water users in terms of organization development followed by formulation of rules and regulations. Holding of meetings, elections, record keeping, etc have assumed regular activities now. In other words, the development of capability of governance or administration of the WUA as an organization, in general, is very remarkable. In case of NWGIS, the institution seems quite weak internally without strong base of water users. One of the

reason for such case is the haste taken by authority in transferring the responsibility of irrigation management to the users.

(vii) However, the perception of strong and effective WUA is prevalent in comparatively smaller system Panchakanya but not so strong in case of Khageri and Nepal West Gandak. The study revealed that the farmers in NWGCIS have voiced against the activities of the WUA main committee. They have accused the executives of being indulgent in party politics, non-transparency and mis-management of funds. The WUA and committees of some of the branches were found irresponsible in system operation and maintenance.

(viii) Speaking of fund raising activities, it is good in PIS and can be hoped to better in future. The fund raised by WUA should be enough to meet the cost of normal operation and maintenance of the system. In KIS, the situation cannot be said to be better at this juncture in the matters. There is lack of communication between the main committee and the branch/minor committees and further down level groups. The situation in NWGIS is quite discouraging and some immediate measures to alleviate the current undesirable developments are awaited as early as possible.

(ix) It has been learnt that the WUA of NWGIS has put up an application to the government to take back the management of the system. At this juncture this is the only solution to revive the institutional and physical status of the system

66. Benefits of IMTP activities can be listed as following in as much as appeared from the study of phase I irrigation systems:

(i) The WUA formation processes, procedures and institutional development from the point of view of needed O&M of irrigation system are some very prominent achievements of IMTP which must have contributed a sense of direction and confidence to the agency staff in their pursuit of management transfer programs in future.

(ii) Some of the undesirable post transfer developments as witnessed in NWGCIS should be taken as lesson learnt from IMTP implementation and not something which deter the spirit of management transfer approach of the government. Actually, such lesson should be utilized to develop subsequent and more efined programs thereafter. For example, the politicizing of WUA provides a food for thought for institutional development specialist as well as policy makers as to what could be the solutions to such developments. Or what types of activities are to be included in post-transfer support program by the agency. From that perspective, even such undesirable developments can be assimilated as outcomes of IMTP.

(iii) At field level, the IMTP activities have been instrumental in (a) establishing organization of farmers for O&M of irrigation systems (b) getting increased

participation of farmers in O&M of irrigation systems (c) getting increased resource mobilization (d) increasing awareness among the farmers, generating ownership feeling as well as the mobilization and conservation of water and financial resources.

(iv) It is evident that the agricultural productions have not significantly increased in IMTP sites despite farmers in KIS and PIS have expressed their satisfaction over the water availability. Definitely some improvements have been made in those systems, that must have been due to better water management in ways of better crop insurance against draught or expansion of irrigated areas with increased water availability. Despite the investment, significant benefits from agriculture in those systems couldn't be drawn. It is however difficult to say that yield per unit area have increased since many improved agricultural practices are still missing in those command areas. Agricultural development packages should go hand in hand with the irrigation improvement package to make the investment sustainably profitable

(v) Judging from the participation of water users in maintenance activities now prevalent in IMTP systems plus the general awareness in terms of cost effective maintenance approaches, it is for sure, the capital expenditures for system maintenance would be lower in comparison to that before the turn-over situation.

67. Likewise, some of the visible short-comings of IMTP activities at this juncture can be listed as following:

(i) In the question of rehabilitation need (or major repair and maintenance activities), it is noteworthy here that a very substantial amount of money is being spent before turnover as a part and parcel of the IMTP program. That would mean that currently the systems are in better shape and may not require major repair budget for quite some time. The question here is – would the WUA be able to generate needed resources if there be need of such rehabilitation works? Actually, we see that there have been quite damages done by the floods this very season in NWGCIS and KIS as well. Perhaps, WUA would not be in a position to fix them as needed. So, as of now, it seems that the need of emergency maintenance has to be addressed crossing the IMTP concept.

(ii) Critics of IMTP are stating that it has been pre-occupied with formulation of WUA and rehabilitation activities. This has come out to be true and signs are more prominent now than before. We witness there have been sharp weakness in WUA in the matters of water resource management as well as managing the resource mobilization. Some of the very important software in terms of water management and resource mobilization management has not been completed as they should be before the turnover.

(iii) It appeared that IMTP has been silent in some very fundamental issues such as the motivational aspects of office bearers of the water users associations. WUA is

conceptualized based on complete voluntary contribution of its office bearers. In big systems like, NWGCIS and KIS, they have to spend very large portion of their daily hours in matters related to WUA. From the angle of transparency and sustainability, it is rather important issue. The intrusion of party politics in WUA of NWGCIS should be evaluated from this angle as well.

68. Some suggestions are as following:

(i) Based on the impact of IMTP so far, it seems that such program should not be done in tight time schedule basis. A joint management approach should be followed as long as it needs based on the situation of any individual irrigation system.

(ii) The agency should not think that its role or activities it is supposed to perform ceases after the event of turnover. On the contrary, it is evident that more activities are required there. Software activities such as water measurement, water resource management, resource collection administration should be profusely undertaken even after turnover. Apart from that, there has to be some efforts in bringing other stakeholders as well that contribute in increasing agricultural production.

(iii) Turnover of an irrigation system to WUA is compared to a bride being sent to her bridegroom's house. There still exists a relation between the agency and the WUA that surfaces more prominently at the times of need.

CHAPTER - I
INTRODUCTION OF THE STUDY

1. Introduction

The Irrigation Management Transfer Project (IMTP) has been implemented since 1995 with the objective of improving Agency Managed Irrigation Systems (DOI managed) and transferring (fully or partly) the management of the system to the concerned Water Users Associations (WUAs). The approach, conceived in the project, has two major components viz. (i) formation and strengthening of WUAs and (ii) rehabilitation of required physical infrastructures.

The approach forwarded by the IMTP, as conceived during its formulation, has been that both software and hardware components have to be attended side by side in the pursuit of improving the irrigation system performance of any irrigation system in a sustainable manner; The main concept being to groom the water users themselves to take care of both physical maintenance need of the system as well as all other operational management needs. Unlike the past trend of rehabilitation approach, wherein the agency used to attend all repair and maintenance works on its own, the approach foreseen here in this project has been to let the WUA themselves to assess such repair needs and to undertake the resource mobilization aspect also so that they would be well aware of such needs in coming times.

In line with the government policy of carrying out evaluation of key projects and programs in phase wise manner to see whether they are having their desired impact on the targeted population and to distil lessons for future policy making, National Planning Commission Secretariat (NPCS) is carrying the study to assess the effectiveness of investment of the project in the current fiscal year. The NPC has provided to the Department of Civil Engineering, Institute of Engineering, Pulchowk Campus, the responsibility of "Evaluating the Effectiveness of Investment in Irrigation Management Transfer Project". Central Monitoring and Evaluation Division (CMED) of NPCS has taken the responsibility to oversee and supervise the proposed study including the fieldwork. A steering committee has been formed in NPCS to review and guide the study.

The Department of Civil Engineering, as an expert consultant, has, in line with the TOR of the contract, conducted the study on evaluating the effectiveness of investment in the three sub projects of the IMTP viz. Panchkanya, Khageri and West Gandak, which were turned over completely (Panchakanya and Khageri) or partially (West Gandak) in fiscal year 2055/56 to the respective WUAs.

2. Background

Agriculture is the backbone of the Nepalese economy. Increasing overall productivity and production of this sector has been critical for His Majesty's Government of Nepal's objective of alleviating poverty. For this, extending irrigation facility to the arable land is one of the major programs of the government. It has been estimated that by the end of the Ninth Plan the total area having irrigation has reached to 1121441 ha. Of this, HMG/N through its Department of

Irrigation (DOI) under Ministry of Water Resources (MOWR) has developed 820506 ha of irrigable land.

It is being increasingly realized that active and constructive participation of local farmers in the operation and maintenance (O&M) of irrigation projects is highly essential for the sustainability of the projects as it ensures ownership on the part of local stakeholders. In view of this, IMTP is being implemented with the loan assistance of the Asian Development Bank (ADB).

The Project has the major objectives including improving irrigation system performance, increasing agricultural production and farm incomes, generating employment, reducing the incidence of poverty and reducing government operation and maintenance budgetary requirements through the establishment of WUAs and rehabilitation and improvement of irrigation and drainage facilities. The two main objectives of the project are to (i) refine and institutionalize the processes and strategies for transferring operation and maintenance (O&M) and/or ownership of public irrigation schemes to farmers, and (ii) transfer the O&M and/or ownership of 11 public irrigation schemes covering an aggregate command area of about 67800 ha to farmer beneficiaries. Under the rehabilitation and improvement of irrigation and drainage facilities, the project is supposed to support the rehabilitation and improvement of irrigation and drainage facilities in about 67800 ha. Also, it purports to support for improving 730 KM of canal service roads by grading and graveling to allow traffic during the wet season.

The project area consists of 11 sub projects in five development regions and covers a total command area of 67800 ha. The project area has about 38000 households or 210000 persons. The average farm size ranges from 0.70 ha to 2.20 ha. Land ownership is strongly skewed, with 10-20 percent of households owning about 50-60 percent of the cultivated land while an estimated 25 percent of cultivated land is farmed under tenancy conditions. Most of the beneficiaries are small-scale farmers who live below poverty line. About 57 percent of the people in the project area were poor. The average per capita income in the project area ranged from NRs. 1706 ($34) to NRs. 5084 ($102) per year, well below the poverty line of $150 per person per year. These low-income farmers were the target beneficiaries of the project. *(Feasibility Report, IMTP, 1992)*

The rehabilitation and Improvement of Irrigation and Drainage Facilities under the project included (i) Emergency maintenance and flood damage repair (ii) Essential structural maintenance (iii) Catch-up maintenance (iv) System improvement works (v) System calibration and establishment of flow measuring works (vi) Improvement of canal service roads and farm to market roads (vii) Repair and procurement of equipment and vehicle. The project was designed to help the government improve the O&M of existing public irrigation schemes on a sustainable basis using the farmers' participatory approach. The project has aimed to complement ongoing efforts to promote economic growth, and reduce poverty in rural areas. Among other crosscutting issues, it was designed to address poverty reduction and increased involvement of women in development (WID), higher beneficiary's participation and institutional building content.

The IMTP was envisaged to be completed in two stages. During the first phase of IMTP implementation, the activities were primarily focused on the three irrigation systems viz. Nepal West Gandak Irrigation System (10300 ha), Khageri I.S. (3900 ha) and Panchkanya I.S. (600 ha). In the three irrigation systems, system rehabilitation and physical improvement works were carried out in consultation with the WUAs.

At present all the three systems have been practically handed over (Panchakanya Irrigation System: fully transferred on July 1997, Khageri Irrigation System: all the system transferred except the main canal system was handed over in July 1999 and West Gandak Irrigation System: all the system fully transferred to WUA in July 1999). The general background of each of the three irrigation systems and activities under IMTP will be briefly discussed in the following sections later in this report.

At this time when a number of years has elapsed since the three systems have undergone management transfer, it was highly desirable to study its impact on the beneficiaries, their economic life, continuity and sustainability of the systems, institutional development and gender issues. While there was a room to review the pros and cons of the approach and the processes that were followed during the implementation of IMTP, there was rather an obvious and immediate curiosity to know as to what benefits the target farmers obtained as a result of the investment in those irrigation systems. Some of the relevant questions were as follows; Has there been improvement in system repair/maintenance situation? Has there been improvement in water distribution? Have such improvements, if there were, contributed in bringing any positive change in terms of crop production and productivity leading to improvement in economic situation? It is understandable that the answers to above queries are important to the WUAs themselves, the implementing agency as well as the planners at the national level.

3. Objectives of the Study

"The Effectiveness Evaluation Study" is designed to assist the NPC in judging the impacts of investment in such projects and the effect of the approach for future development of priorities and plans at national level. The study specifically focuses on:

- Finding out whether O&M cost is recovered through the collection of irrigation service fees,
- Examining the current status of WUAs, (their formation in terms of gender, coverage in terms of households, frequency of the meetings of WUAs),
- Assessing the increase in crop yields (the project envisages that the crop yield increases by 10-20 percent)
- Examining the increase in crop intensity (it is assumed that the cropping intensity increases from 167 percent in 1994 to 197 percent by 2001),
- Assessing the increase in net income per family (the project envisages that net income per family will increase by 20-30 percent at full development of the sub projects),
- Examining the economic rate of internal rate of return (supposed to be 22 percent),

- Assessing the appropriateness and the relevance of the design, inputs and implementation arrangements as well as the sustainability of the benefits generated by the sub projects,
- Assessing the strengths and weaknesses of the sub projects by studying the targeted and actual facilities developed,
- Assessing the actual number of households benefited, participation and involvement of women, poor families and under privileged castes, community participation and the level of participation of beneficiaries in the project including their attitude towards such projects and future perspective, and
- Recommending the future course of action to be adopted by the government keeping in view the factors such as sustainability, operation and maintenance cost, long-term and short-term national needs, etc.

4. Scope of the Study

The study covers the three irrigation systems of Panchkanya, Khageri and West Gandak. It is being carried out in close cooperation and under the supervision of the Central Monitoring and Evaluation Division of the National Planning Commission Secretariat. Major activities under the study undertaken by the consultant in line with the TOR comprised the following:

(i) Field observations to assess:

- The increase in crop yields, in cropping intensity and in net income per family.
- The economic rate of return (EIRR) of the sub projects.
- Physical performance of the systems in terms of irrigation water delivery
- O&M mechanism within the systems
- Functional status of WUA and beneficiary's perception on ownership of the systems

(ii) Study of effectiveness of the turned over sub projects considering factors such as sustainability, O&M recovery through collection of irrigation service fees, stakeholders' participation and relative strengths and weaknesses of the project.

(iii) Examination of the current status of WUAs, (their formation in terms of gender, coverage in terms of households, frequency of the meetings of WUAs),

(iv) Study of overall socio-economic benefits from the sub projects,

(v) Recommendation of the policy to be adopted by the government for planning and financing the projects of similar nature,

(vi) Identification of potentialities created by the sub projects for various development activities.

5. Limitation of the Study

The study was designed and conducted to address the objectives and the task within the scope of the study. Given the time and resource constraints, the study has some limitations over the collection of data/information as well as over the analysis of the information. The limitations of this study are briefly given as follows.

- The data and information pertinent to the study are mainly gathered by PRAs, household surveys and interaction with key informants of the system. Information obtained through person to person talking have reflection of inherent biasness of individuals. Also, references to the records of WUA of respective irrigation systems and concerned offices have been made. Experience shows that the records are not always complete and true. Though the consultants have tried to cross verify the information obtained from secondary sources, not all the data could be verified.
- Despite the questionnaire developed covers most of the response that are relevant to the study, the questionnaire was designed not to be extensive in terms of getting all the information from the farmer respondent. Also questions to farmers demanded their answers/response in terms of qualitative assessment of different attributes of irrigation system. Those involved in research are quite aware with the fact the qualitative responses depend on the relative judgment of individuals. These factors are unavoidable though they have significant impact on the results and interpretation of the data.
- The analysis done on the study is mainly descriptive one. No statistical analyses have been carried out to judge the significance of the results.
- Impacts of development are multifaceted and the over all result is the output of a number of interrelated factors. The study hasn't done multivariate analysis to categorically identify the impact of each of the contributing factor to the result.
- The analysis is mainly focused on comparing the changes on different aspects of irrigation system management that have been brought in the system by the intervention program.
- Analysis and interpretation of the impact and the changes is made based on both the qualitative and quantitative information.

CHAPTER – II
STUDY APPROACH AND METHODOLOGY

2.1 Study Approach

The consultants have mainly focused on collection of primary information from the beneficiaries obtained through household survey from the respective irrigation systems and information obtained from the Focus Group Discussions (Participatory Rapid Appraisal) conducted with key farmers and WUA representatives from the respective irrigation systems. Information from secondary sources like the project reports (evaluation reports, impact reports and other studies carried out by concerned agencies) were thoroughly scrutinized. More importantly, the consultants have looked into the documents with a fresh view and also tried to verify the results in the field. Secondary information from the WUAs and concerned government offices were gathered by reviewing their records, minutes and other relevant documents.

Some of the necessary secondary information were collected and studied at the outset in order to carry the study. The major sources of such information were the IMTP coordinator's office and IMD office. During desk study (inception phase) the team comprising of engineers, sociologist, and agri-economist prepared detailed design for the field work. Questionnaires and check lists were prepared accordingly. The team then prepared and submitted Inception report to CMED for approval prior to the field visit. The list of consultants, the enumerators and the organization of the consulting team is given in Annex 2.1.

The consultant has kept close coordination with CMED of NPCS through out the conduction of the study and reporting through meetings and needful communication.

2.2 Field Work

Upon approval of the inception report on 14 Baisakh 2060, the study team headed for field work. The field work was conducted from Baisakh 17 through Jestha 16, 2060 B.S. During the field visit the following major activities were carried out.

- Walk through along the main canal, branch canals, minors and distributaries
- Discussion with HMG personnel at the Department of Irrigation, Division Offices at Bharatpur in Chitawan and Semari in Nawalparasi Districts respectively.
- Meetings with WUA representatives at Main/Branch/Tertiary Levels.
- Meetings with concerned personnel from governmental and non governmental organizations
- Questionnaire based household survey with farmers
- Focus group discussions with farmers, WUA and other related personnel
- Collection of relevant data and information from concerned line agencies of the districts and from concerned WUAs.

The walk through survey included the following activities:

(a) Physical observation of the status of the sub projects

(b) Verification of the structures constructed, rehabilitated and maintained under the projects

The verification/observation was carried out to find out details on the following aspects of the projects:

- Water availability and water control capacity
- Structures
- Water management and administration

The study under water management and administration included:

- Water allocation procedure
- Operational characteristics

2.3 Meetings with Personnel

During and before the field visit several meetings with a number of personnel from the Department of Irrigation at Kathmandu, the Division Offices at Bharatpur and Gauriganj in Chitwan and Nawalparasi Districts respectively, the Non-Governmental Organizations involved at the irrigation systems including CARE Nepal staff at its SAGUN Program, members of the Main Committees at Khageri, Panchakanya, Nepal West Gandak Main Canal, Parsauni and Piparpati Minors of the Main Indian West Canal, the Branch and Distributary Committees, farmers and beneficiaries, etc. were organized and valuable information gathered from such meetings. The checklist used for such discussions are given in Annex 2.2 attached with this report. The name list of participants during different Focus Group Discussions is given in Annex 2.3 attached with this report. The study team also met and had discussion with the then subproject managers of the irrigation systems.

2.4 Physical Observation/Walkthrough

Physical observation of the main canals of the three irrigation systems was conducted by moving alongside the canals using vehicles and motorbikes. Representatives from the respective WUA members also accompanied the walkthrough. Similarly walkthrough survey of the selected branch canals, minors and distributaries were also completed for acquiring first hand information of the existing condition of the canals, associated structures and the adjoining fields. Discussions were made with the users and users' representatives about the approach adopted for rehabilitation of irrigation facilities in the respective canals and the quality control aspects. Some of the selected photographs taken during the walkthrough survey have been shown in Annex 2.4 attached with this report. The branch canals, minors and distributaries selected for detailed walkthrough survey from the three irrigation systems are listed below:

S.N.	System	Selected for Detailed Survey	Type	Remarks
1.	Panchakanya	Numbers 1, 5 and 7	Branch Canals	
2.	Khageri	Numbers 1, 4, 6 (West) and 8	Branch Canals	
3.	West Gandak	Bishnuganj	Sub Distributary	
		Bhujahawa/Manjhariya	Sub Distributary	
		Piprahawa	Branch	
		Bhagatpurwa	Minor	
		Parsauni	Minor	Indian Main Canal
		Palhi	Minor	

2.5 Sampling for Questionnaire Survey

The general approach adopted for selection of households for the household survey was as follows:

(a) Random Sampling using scientific calculator (random numbers function was used for the purpose)

(b) The entire system in all of the three irrigation systems were divided into head, middle and tail reaches and representative samples were selected proportionately from each of those reaches

(c) The beneficiaries were categorized in three classes of high, middle and low land holdings constituting less than 10 kattha, between 10 kattha to 1 bigha and more than 1 bigha respectively. Representative sample from each of the three categories of farmers in each of the branches were selected proportionately for the survey

Such criteria adopted during the selection of households for questionnaire survey is supposed to represent all reaches and categories of beneficiaries and will give representative picture of the effectiveness.

Around five percent of the total households deriving water from respective irrigation systems were selected for interview. System wise selection percentage of households for interview is as follows:

(i) Panchakanya Irrigation System: Around 6% of the total households

(ii) Khageri Irrigation System: Around 5% of the total households

(iii) West Gandak Irrigation System: Around 3% of the total households

The sampling details were as following:

For Pancha-kanya Irrigation System

The branch 1 was chosen to represent the head location situation. The command area lies on Ratnanagar ward no.7. The village at head area of this branch is Beltandi while the village Sisai lies in the middle and the village Dekwa lies in the tail portion. While one farmer's group discussions were held in this branch some 21 households representing different locations along this branch were chosen for household survey.

Similarly, Branch 5 was chosen to represent the middle location situation. This Branch has however, three sub-branches. The command area lies in Ratna-nagar ward no 6. Some 16 households representing different locations along this branch were chosen for household survey.

Similarly, Branch 7 was chosen to represent the tail location situation. The command area lies in Ratnanagar ward no.4. Some 9 households representing different locations along this branch were chosen for household survey.

For Khageri Irrigation System

The Branch 1 was chosen to represent the head location situation. One of the reasons to choose branch number one is also that it is the only branch where irrigation water is available for both the dry and wet seasons. The command area lies on Champanagar (ward no 2), Prithvi-nagar, (ward no 3), Patalhara, (ward no 6). Two PRA meetings at different locations along this Branch were held. Some households representing different locations along this Branch were chosen for household survey.

Similarly, Branch 4 and Branch 6 (west) were chosen to represent the middle location situation. The command area lies in Shiv-nagar, Sundar-basti, Patihani, Bhimsennagar, Sashi Nagar, Padampokhari, Patihani. Sukra Nagar and Sharda nagar and 4 at tail. Two PRA meetings at Branch-4 and Branch- 6 (east) were held. Some households representing different locations along these branches were chosen for household survey.

Similarly, Branch-8 was chosen to represent the tail location situation. The command area lies in Shrada nagar ward no 5 for head and middle, Gunja-nagar ward no 2 at middle. One PRA meeting was held. Some households representing different locations along this minor canal were held. Households representing different locations and categories along this Branch were chosen for household survey.

For West Gandak Canal Irrigation System

The Bishnuganj Branch was chosen to represent the head location situation. Considering the situation that farmers from the tail portion of Bishnuganj haven't received irrigation water since last 5 years due to the damage at the canal due to flood, farmers from the tail end of adjacent Manjhariya minor were chosen to represent the tail reach of head-end branch canals. Households representing different locations and categories along these Branches were chosen for household survey.

Similarly, Bhujahawa and Piparhawa branches were chosen to represent the middle location situation. Two PRA meetings in each of these branches were held. Households representing different locations and categories along this Branch were chosen for household survey.

Similarly, Palhi minor and Bhagatpurwa minor were chosen to represent the tail location situation. Two PRA meetings at different locations along these branches were held. Households representing different locations and categories along this Branch were chosen for household survey.

Owing to the limitations of time and resources and because it is a large irrigation system with more than 10,000 households it was not possible to stick to the originally targeted five percent household for questionnaire survey in case of the West Gandak Irrigation System.

The name list of beneficiaries at respective branches, distributaries and minors at the three irrigation systems were obtained from the respective committees. In case of Panchakanya and Khageri the name list were obtained from the branch committee offices whereas in case of West Gandak it was obtained from the Acting Main Committee office at Gopiganj. In many of the branches of PIS and KIS and also in case of NWGIS the complete name lists of all of the beneficiaries were not available. The available name lists from the shareholder's registers were referred in such cases. The name list of the water service fee collection register available at the branch and main committee offices were also referred for the purpose.

2.6 Questionnaire Survey

The questionnaire was prepared in Nepali for simplicity to the enumerators. Around six hundred questionnaires were used for the interview in all of the three systems. Given the suitability and appropriateness as felt by the study team during the field visit the sample questionnaire submitted during the Inception Phase was slightly improved at field to incorporate more appropriate information relevant to the study. The questionnaire used during the survey is given in Annex 2.5 attached with the report.

2.7 Evaluation and Analysis

2.7.1 Performance Indicators

Questionnaire filled up by the beneficiary farmers during the field survey and also the check list for focus group discussion was designed to evaluate the impact against the following key indicators of performance/impact of the project.

2.7.1.1 Water delivery System

Effectiveness of the water delivery system to the farm heads has been judged based on the performance of the irrigation system including both structural as well as management part ensuring:

- Adequacy
- Timeliness
- Equity, and
- Joint Effects

2.7.1.2 Irrigated Agriculture System

Effectiveness of the irrigated agriculture system on the whole has been judged based on the agricultural productivity of the target areas. The scenarios prior to the project/sub projects and the existing scenario has been compared. The extent of increase or decrease irrigation area and in the agricultural productivity has been taken as the key to determining the effectiveness of the irrigated agricultural system.

2.7.1.3 Agricultural Economic System

The impact of the project on the agricultural economic system at the project area has been evaluated by considering the following factors. Basically comparisons based on the following factors have been made for the two situations of irrigation management in those irrigation systems; one prior to turnover case and second five years after the turnover of the management.

- Gross revenue from the crop production
- Net value added
- Net income to the farmers
- Average labor productivity
- Economic rate of return of the investment

2.7.1.4 Other Indicators

Apart from the above-mentioned indicators for assessing the performance of the irrigation systems, the following has been carefully studied:

(i) Social Indicators:

Under the social indicators, the following two major parameters have been considered:

(a) Social Capacity:

The social capacity of the beneficiaries shall be evaluated based on the following criteria:

- Response capacity
- Degree of farmer involvement in system management
- Effectiveness and legitimacy of farmer organization
- Ratio of level of knowledge vis-a-vis what is required given a person's role (i.e., beneficiary farmers, WUA members, etc.

(b) Social Impacts

The social impacts due to the project on the beneficiaries have been evaluated based on the following criteria:

- Farmer satisfaction (as measured by surveys, distributions and volume of complaints against the agency, disputes among the farmers, etc.)
- Employment generation (comparison of number of days per ha, relative wages, farmers incomes)

(c) Sustainability Indicators

The sustainability indicators have included the capacity of the beneficiaries to continue to benefit from the project for longer periods of time. This has included the institutional management capability, participation of each and every beneficiary in the whole process of irrigation and benefits, institutional buildup, role of women in decision-making, etc.

(d) System Descriptors and Process Indicators

The system indicators include the interconnection between the different sub systems including social, economic and cultural systems as well as the continuing impact of the change effects caused by the project to the day-to-day life of the beneficiaries. The study has looked into the physical sustainability of the system in terms of geo-ecological characteristics of the irrigation system and the potentiality of the social and economic factors within the system to make the system physically sustainable over a longer period of time.

CHAPTER - III
DESCRIPTION OF THE IMTP PHASE-I SUBPROJECTS AND IMT ACTIVITIES IN NEPAL

3.1 Description of the systems under study

A brief discussion on the irrigation systems under consideration is given as follows

3.1.1 Pancha-kanya Irrigation system

Pancha-kanya irrigation system has its origin history of being a Rajkulo, which came into being about half a century ago through the initiatives of the local inhabitants. It was only in 1977 (2034 BS) that the government intervened here along with the inception of Chitwan Lift Irrigation project. The headwork, which comprises of a weir type structure with a front intake, make up of brick and stone masonry, is constructed at a location, which is about 1.8 km north from the road head of the highway. Originally, it was designed to serve some 600 ha of land of Ratna-Nagar Municipality situated at south of highway and north of Sauraha and the Chitwan National Park. The source of water is the perennial Pancha Nadi, which is formed by the confluence of five different natural springs.

The total length of the main canal is 5 km and it flows north to south and then to south east. There are five outlets north of the highway which supply irrigation water directly to the field of about 20 ha in total. There are eight branch canals. It has 12.1 km of total branch canals, 5.3 km of tertiary and 16.9 km of service road and 4 km of main drain. Division structures are built at the branch canal bifurcation points. These structures are all gated with steel frame and steel and/ or wooden panel. Check structures are also built at the downstream portion of the division structures, which are made of brick masonry having one piece steel frame.

This system came under Joint Management Program in 1993 and the formation of water users association was done at that time while the formal registration was done in May 1994 (2051/2/16). With the inception of IMTP here in June 1995, MOA was signed between WUA and DOI in Jan 1996. Several institutional strengthening and system improvement activities were undertaken. Various activities were undertaken to improve the existing WUA. An array of training activities was also conducted to build capacity of WUA executives and other supporting farmers. About NRs, 6 million was spent from government side in improving the physical system under the IMTP after signing agreement of system transfer with WUA. Several structures including the headwork were repaired with that fund. Much of lining works along the main and branch were undertaken too. NRs. 1.1 million from the WUA contribution amounted to different activities such as silt removal from main and branch canals, extension and re-excavation of tertiary canals as well as leveling, grading, gravelling and extension of service roads. The system was handed over practically to WUA from July 1997 (20/03/2054). However, the formal handover ceremony took place on 28 Mangsir 2054. The map of Panchakanya Irrigation System is given in Annex 3.1

3.1.2 Khageri Irrigation system

The initiation of this irrigation system was begun in 2019 BS and completed in 2024 BS. The water is diverted from Khageri Khola. The headwork in this system is located at some 10 km east of Narayanghat on the Highway at Tikauli. It has a command area of 3900 ha covering eight VDCs with some 31000 population viz. Sharada Nagar, Jagatpur, Gunjanagar, Shivanagar, Parwatipur, Patihani, Sukranagar, Gitanagar and Mangalpur VDC as well as ward number 9 of Ratna-Nagar Municipality. The main canal length is 22.5 km. It has eight branches, 4 minors and several pipe outlets along the main canal. The length of branch canals measures 55 kms in total. It has a design discharge of 8 cumecs.

Since the source river is very much dependent on the rainfall, the dependability of the irrigation water has remained quite questionable. For that reason, it was proposed that there should be water supply of about 2.52 cumecs from Chitwan Lift Irrigation Scheme. However, this arrangement has not been materialized so far due to problems in the latter.

This system was operated under joint management program of the DOI under Irrigation Management Program of USAID in 1992. The WUA was registered in November 1992 (2049/10/10). Later, it was included in IMTP phase I program. With the inception of IMTP, a memorandum of understanding was signed between the DOI and the WUA on January 1996 (2052/9/17) for the repair maintenance works and some rehabilitation works as well as preparatory work for hand-over process. About NRs. 27 million is spent to improve the physical system as planned during the signing of agreement. The contribution from the WUA amounted to 2.6 million. The layout of Khageri Irrigation System is given in Annex 3.2

3.1.3 West Gandak Irrigation System

Nepal Gandak Western Canal Irrigation System extracts water from Narayani River through a head regulator constructed about 600 meter upstream of the barrage which is located in Nawalparasi District. Also, there is another system viz. Piparpati-Prasauni Minor which draws water from the main Western Gandak Canal which draws 18800 cusecs of water to Indian land. The former has a design discharge of 1.86 cumecs (66 cusec) for estimated 1600 ha of land while the latter has 8.5 cumecs 9300 cusec) for estimated 8700 ha of land. Initial construction took place 1976. It serves a population of 110000 residing in 22 VDCs. The NGWIS went under further development with the Command Area Development Project financed by ADB between 1982 to 1989. Currently, the infrastructure consists of 32 km of main canal, 72.5 km. of branch canals, 10.5 km of secondary canals, 657 km of tertiary and 110 km of gravel road networks.

In 1992, this sub-project came under a joint management program of DOI. Institutional development activities of water user's group formation (WUAs/WUGs) and training on share system, operation and maintenance, etc were undertaken during the period. This system was also operated under joint management program of the DOI under Irrigation Management Program of USAID. The WUA was registered in 2050/3/15. Later, it was included in IMTP Phase I Program. With the inception of the IMTP, a memorandum of understanding was signed between the DOI and WUA for the repair maintenance works and some rehabilitation works as well as a preparatory work for hand-over process. Several institutional strengthening and system

improvement activities followed thereafter. Various activities were undertaken to improve the existing water user organization. Training activities was also conducted to build capacity of WUA executives and other supporting farmers. The WUAs were provided technical training related to share system, operation and maintenance, book keeping and financial management, etc. About NRs. 26 million is spent to improve the physical system as planned during the signing of agreement. The contribution from WUA amounted to NRs. 2.9 million. The layout of the Nepal West Gandak Irrigation System is given in Annex 3.3.

3.2 Background of Irrigation Management Transfer in Nepal

The world-wide interest in user participation in development in the 1980s also changed the course of irrigation sector development in Nepal. The attention shifted towards management improvement in completed systems, rather than new construction. Irrigation interventions were then directed at promoting local management, and participatory design processes were adopted to support the evolving organizations. The USAID started the Irrigation Management Project (IMP) in 1986, which worked as the foundation for future irrigation management reform in the country. The major aim of the IMP was to improve irrigation management practices in both agency-managed and farmer-managed irrigation systems. It aimed to develop and sustain irrigation management activities by improving the capacity of both DOI professionals and water users through training and research activities (Shukla and Sharma, 1997). The IMP activities were facilitated by a joint team of Consultant firms – Louis Berger International Inc. (American), East Consult (Nepali), and Cornell University (American). The objective of the IMP was reformulated in 1989: to support the DOI in implementation of the participatory management program. The scope of the work was reduced, and a new consulting firm the Computer Aided Design Inc (CADI) was hired by the USAID to support the IMP activity.

The IMP later supported the joint management program that began in 1992, including both Khageri and West Gandak systems. The IMP ended in 1994, but the USAID continued to support the new project, the Irrigation Management Transfer Project (IMTP) hiring the same consulting firm, CADI. The IMP also carried out pilot programs in the two agency managed irrigation systems, Sirsiya Dudhaura in the Terai and Handetar in the Hills the objective behind these two pilot experiments was to utilize the experience and lessons learned to implement similar programs in other parts of the country. The IMP formed the base for further implementation of participatory programs in irrigation. The IMP was the major player in formulating the new policies, acts and regulations that began in the 1990s, as will be discussed in next section.

Another important event that helped initiate reform in irrigation sector was the Basic Needs Policy (1987) of the Government. The irrigation sector was one of the most prioritized sectors in this policy, as food security was its prime concern. The government introduced a Working Policy on Irrigation Development (1989) focusing on user participation. This document provided new directives to Nepal's irrigation sector, mandating participation of user farmers at all levels of irrigation development, from project identification, design and construction to operation and management. This policy specified a cost-sharing arrangement between the farmer

and the government in development both gravity and pumped schemes. This policy also set out action plan for joint management and management turnover of the AMIS.

The Basic Needs policy also led the widespread expansion of the irrigation bureaucracy in the country, establishing the district level offices in 1988. Previously, there were only divisional offices at required places. The need to expand the irrigation bureaucracy was recognized because there were no other government agencies to look after the irrigation development at district level.

The Working Policy was immediately followed by the Irrigation Regulation (1989). The regulation for the first time prepared the legal basis for WUA formation and registration. The strategy of increasing farmer participation mainly stemmed from recognition that government resources alone were inadequate to meet the country's irrigation development objectives and sustain the management of government objectives and sustain the management of government irrigation systems after their completion (Pradhan, 1996).

With these ongoing changes, both the priority and approach to irrigation development in Nepal took a new direction. Priority now shifted to management improvement of large-scale public irrigation systems and the rehabilitation and extension of existing FMIS, rather than on the construction of new large systems. Intervention in FMIS received a major thrust. The majority of the FMIS had been considered outside the Government's domain, although they irrigate more area than the government-built systems. Even at present, some 70% of the total irrigated area of 1.12 million ha is managed by FMIS. It was believed that much of the country's food production could be generated from the rehabilitation and extension of these FMIS as studies had shown that many of them were performing below their potential, especially due to technical problems (Paudel,1992).

Intervention programs implemented since then include the Irrigation Line of Credit (ILC) pilot project (1989); the Irrigation Sector Project (ISP in 1990) and the special public work program of ILO. Out of these the ILC and ISP was funded by the WB and the ADB, with long-term commitment for irrigation development. The two projects are now at their final stage and called Irrigation Sector Support Project (ISSP) and the Nepal Irrigation Sector Project (NISP). Both these major funding agencies abandoned the individual project approach to development, and adopted the program mode such that learning from one site could be used for another. These programs mainly involved the physical rehabilitation and expansion of FMIS as well as capacity development of user farmers. It was based on a demand-driven approach, and users were required to pay part of the construction cost, based on scale and type of development varying from 5% to 25%. User involvement during design and construction was also made mandatory, including the prioritization and approval of the construction works. Users were also allowed to execute the construction work by themselves if the cost was below NRs. 1 million.

Despite this, large-scale AMIS remained untouched by the reforms. The Command Area Development Project (CADP) initiated in 1982 planned to involve users in project implementation. The CADP was started in three irrigation systems including the West Gandak, but it could not succeed as users were organized at a very late stage of project implementation

However, these groups vanished in most cases as soon as the project ended. These groups were created at the end of the project period when construction activities were over and did not feel responsible for later operation and maintenance. These groups also did not receive continued support from the DOI to improve their canal management capacities

3.3 The New Policies and their Legal Context

In 1990, the Panchayat system was overthrown and the Basic Needs policy also ended. By 1991, the newly elected government was in charge with multiparty democracy established. The government initiated liberal policies limiting the role of government and promoting private sector involvement, which still continues. In the agricultural sector, first the subsidy on fertilizer was removed and the private sector allowed to import and market fertilizers. By 1997, the government also started to withdraw subsidies from shallow tubewell development. In the irrigation sector, the O&M of the AMIS was known to be poor, and users' participation in management was seen as a viable option (Irrigation Master Plan, 1990). Several policy reforms and legal changes were thus made in 1992 affecting water sector development. These policy reforms were shaped to promote participatory management in the irrigation sector.

The Irrigation Policy formulated in 1992 was a continuation of the previous Working Policy with a major focus in the participatory approaches in irrigation development and management. The policy classified irrigation systems into four categories: Farmer-Managed Irrigation Systems (FMIS) developed and managed by farmers; Agency-Managed Irrigation Systems (AMIS), which are to be transferred to the WUA or jointly managed; Groundwater Systems including both shallow and deep tubewells; and Privately Owned Systems. Under the policy, the responsibility for supporting the first three types of systems was kept with the DOI whereas the responsibility for the private systems was left with Agriculture Development Bank of Nepal (ADBN). All systems with less than 10 ha area (changed to 25 ha after an amendment was made in 1997) were considered private systems.

The policy also set out the conditions for joint management, or full transfer of the AMIS, depending on the size of the project. Accordingly, AMIS of up to 500 ha in the hills, and 2000 ha of irrigated are in the Terai, are to be gradually turned over to the Water Users Associations. However, the policy does not bar handing over even bigger systems, if feasible, based on WUA capacity and structural complexity of the irrigation systems. In general, projects larger than 500 ha in the hills and 2000 ha in the Terai which cannot be turned over to the WUA, are to be jointly managed by the concerned irrigation office and WUA.

The policy also encouraged the WUA to be self-reliant and granted them the status of a full autonomous body. It states "His Majesty's Government shall not realize irrigation service charges on the turned-over surface and groundwater irrigation systems. The concerned water users may realize service charge for the maintenance, rehabilitation, improvement and operation to be carried out by themselves. The WUA itself may, as required, determine the rate of such charges. In cases where joint system management has been introduced an exemption shall be given to the water user to the extent of 50% of the irrigation service charge as prescribed by His Majesty's Government" (Irrigation Policy, 1992)

The DOI was also restructured after this policy reform, and a separate unit – the Irrigation Management Division (IMD) – was created especially to look after the O&M of the large systems, as well as to facilitate the IMT programs.

Soon after the promulgation of the Irrigation Policy in 1992, a new Water Resources Act was enacted in 1992 replacing the previous Canal and Electricity Act (1967). The Act sets out provision for building the WUA, and handing over systems developed by the government to such WUAs. It states that "His Majesty's Government may, on terms and conditions as are necessary, turn over to the users association any water resources project developed pursuant to Subsection 1 or 2 of Section 10 after its completion." The Subsections 1 and 2 of Section 10 reserves the right of the government to take over any water resources projects developed privately with necessary compensation, if required, considering the wider public interest.

The Act also states that all concerned users associations shall have the ownership of the system turned over, and the concerned user association shall operate such systems as if it has a license under this Act. As per the Act, the WUAs are an autonomous and corporate body having perpetual succession (see Box 3.1). The Act has kept ownership of water with the state. However, it has made provision to transfer water rights by issue of a license. Persons or corporate bodies are required to obtain a license to carry out a survey, as well as for the utilization of water. The license requires payment of annual fees, and it can be sold or transferred upon prior approval of the authority issuing the license. However, it is not required to take a license for domestic purposes and for use with first priority given to drinking water before irrigation Subsequent priority given to drinking water before irrigation. Subsequent priorities in order are for other agricultural purposes, hydropower development, industry and mining, navigation and recreational use.

Two provisions in the Act greatly influence water sector reform. First, although the water right is vested with the state, it can provide concessions through licensing, such that the licence holder gets a right over the water it licensed. Second, it recognizes a WUA as an autonomous body with legal authority. It empowers the WUA to decide their operation and maintenance pattern, as well as to charge users for the service delivered, granting them the status of an individual license holder.

Box 3.1

WUA as an Autonomous Body

- A Users association shall be an autonomous and corporate body having perpetual succession.
- A Users allocation shall have seal of its own for the purpose of all its business.
- A Users Association may as a person have the right to acquire, enjoy, sell, dispose or arrange of movable and immovable property by any means.
- A Users Association may sue as a person or be sued.

However, the Act is unclear on three aspects. First, the provision for joint management is not clear. Second, the Act says nothing about the conditions of the transfer, like the obligations and duties of both government and WUA after transfer, and what properties and resources of irrigation systems owned by the government are to be transferred. Third, the procedures for issuing the license and the conditions to obtain the license are missing in the Act.

Following this Act, a Water Resources Regulation was enacted in 1993. The main feature of this Regulation is that it formed a District Water Resource Committee (DWRC) to issue licenses for water use for private sector actors seeking to develop water resource projects. It also simplified the WUA registration process, making the DWRC responsible for the registration of the WUA. The DWRC is headed by the Chief District Officer of the concerned district. The other members include the chief of concerned District Irrigation Office, Local Development Officer and Agriculture Development Officer. Previously, the registration of the WUAs was regulated under a separate Act called the Institution Registration Act (1976), which is more related to the registration of non-governmental organizations (NGOs). Irrigation Regulation (1993) cleared some of the limitations of the WR Act, but it failed to mention anything about the conditions for turning over irrigation systems to WUAs. All these policies and Acts have failed to address an important factor, considered crucial in the reform: the issue of an Irrigation Service Fee (ISF). In fully transferred systems, it is understood that the WUA can set the fees and collect them under the rules set by them, because of their autonomous status. However, there are no legal provisions by which the newly established WUAs can enforce collection of fees. In jointly managed systems, it is unclear who will fix the ISF rate, or who will collect it. The Irrigation Policy was amended in 1997 to clear up some of these confusions. It allows the WUA in jointly managed systems to collect the ISF and fix its rates. Under this revised policy, farmers' payment to government decreases, as farmers take control of the larger part of the irrigation. (Table 3.1). Previously, only 50% of the collection could be retained.

Table 3.1: Division of ISF between government and DOI under varying management situations

Situation	WUA Share (%)	Government Share (%)
WUA management of whole system	100	0
WUA management whole system except the head work	90	10
WUA manage whole system except the head work and main canal	75	25
WUA manage only up to the blocks	50	50
WUA manage only the tertiary canal	25	75

The Irrigation policy emphasizes on the improvement of irrigation services and encouraged involvement of beneficiaries in the management of irrigation systems. The FMIS are to be turned over to the users after construction or improvement. Similarly in case of the AMISs, the management responsibility will be transferred to the users' organization. The policy also sets the percentage of contribution to be made by the WUA in the construction activities as given in Table3.2. Thus the policy has made the beneficiaries' contribution prerequisite for irrigation development in the country.

Table 3.2: Minimum contributions to be borne by the users in different scheme development

WUA managed systems (FMISs)				Systems under IMT			
New Construction		Improvement		New Construction		Improvement	
Hills	Terai	Hills	Terai	Hills	Terai*	Hills	Terai
5-7%	10%	7-12%	15%	5%		10	10

Source: Irrigaiton Policy, 1992 (as amended in 1997)

* *In the Terai, under new construction, users are required to build watercourses below 10 ha on their own and contribute 25% of the cost for construction of tertiaries serving 10 to 30 ha.*

The problem is that these policy guidelines are not supported through new Acts and Regulations, and have no practical dimensions, as policy documents are not legally binding. So the question of ISF remained unclear among all the parties (both farmers and engineers) working in the field. In addition, the problem of transfer conditions from the government to the WUA also remained unclear. The problems and issues related with the policies and regulations has been discussed in chapter 6 of this report..

3.4 From Irrigation Policy to Irrigation Management Transfer Program

The present policy of IMT originates out of the 1992 Irrigation Policy. With this policy, management responsibility for the AMIS is to be transferred to the WUA. The Agriculture Perspective Plan (1996) further plans to have all AMIS to be handed over to farmers or jointly managed by 2015. The framework of IMT in Nepal is shown in Figure 3.1 (Khanal, 2003).

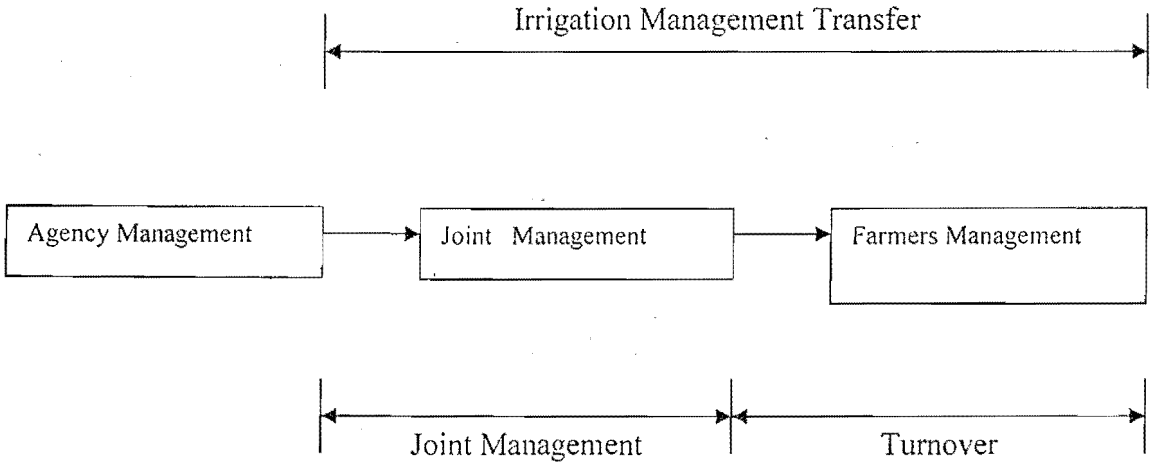

Figure 3.1: Framework for management transfer process by the DOI

The turnover program aims at the complete transfer of O&M responsibilities of small and medium scale irrigation systems to legally recognized water user groups. Turn-over is said to occur if the whole system is transferred to the WUA, as will be studied for the Panchakanya system. Joint management can follow several forms depending upon the size and technical complexity of the system. The most general form for the joint management is that the irrigation agency operates and maintains infrastructure to a certain point of delivery, after which a local

organization takes over responsibility of water delivery (Molden and Sharma 1999). However, joint management can also be achieved without partial turnover of the system. In this, a shared responsibility is defined between the state and the users for the OM of part or whole of the system

Following this policy statement and Water Resource Act, joint management programs were started in 1992 in five selected irrigation schemes covering 33,600 ha, including the Nepal West Gandak Irrigation System (8000ha) and the Khageri Irrigation System (3900ha) studied here. They began with the formation and capacity development of WUAs in these systems. These activities were supported by the IMP, and the consultant firm CADI was involved in WUA formation and training them. However, farmers in these systems showed their concern over the poor condition of physical infrastructure and asked for system improvement together with the institutional development program. It was reported that before beginning the joint management program, most of these systems irrigated only about 50% of their targeted area. This was mostly due to lack of proper O&M practices and poor condition of physical infrastructure.

The DOI then planned the rehabilitation of these systems together with the organizational development activities. There was a growing concern whether to carry out system rehabilitation together with the joint management program or after it. In one hand there was fear that if the rehabilitation were attached with the IMT, it would be a time-bound activity, and participatory management could be jeopardized. Also there was fear that it might end up with construction. On the other hand it was also realized that it would not be possible to encourage farmers to take up management responsibility unless system efficiency was increased. Also the farmers were also not ready to take-over the management responsibility without proper repair and maintenance of the systems. Finally, the DOI decided to carry out early rehabilitation of the systems selected for the IMT program, as the stakeholders (DOI, and the farmers) had favored the system improvement together with organizational development.

A loan request was then made by the government with ADB to finance the rehabilitation of the systems selected for management reform. The ADB, after a feasibility study in 1994, agreed to finance the rehabilitation of the identified schemes, under the Irrigation Management Transfer Project (IMTP). This loan request did not involve much discussion, as the necessary conditions for the management transfer program were already in place. The policy of the management reform was consistent with the ADB policy. The Irrigation Policy 1992 was in fact designed to address donor concerns regarding user participation in irrigation management. Likewise, the USAID was long involved (and was a key actor) in irrigation sector reform in Nepal through the IMP and was interested to continue further support the process of management reform in Nepal. The DOI was desperately in need of funds to improve the system conditions. The match of interest of the key actors in the IMT program thus made the loan process much smooth.

The IMT policy ultimately changed into program action through the Irrigation Management Transfer Project (IMTP). Altogether there were 11 sub-projects at the start of IMT of the country. Only one out of these 11 sub-projects, the Chaurijahri, is in the hills: the remainder are in the Terai. These systems are scattered in all five-development regions of the country. These

systems were irrigating 32000 ha against their target command area of 67000 ha in total (efficiency of less than 50%) because of physical and operational constraints (GITEC 1992). These systems cover about a third of irrigated area under the control of the DOI.

The ADB was to finance the physical rehabilitation component of the IMTP whereas United States Agency for International Development (USAID) agreed to provide the Technical Assistance (TA) to the program. The ADB loan was US$11 million, which is 59% of the total project cost of the IMTP. The remaining 41% of the costs were to be borne by the government and through farmers' contribution. In Chapter 5, it will be shown how the 41% cost was divided to 15% for the government and 26% to the farmers. The USAID assistance of US $ 3 million came in the form of grants and was meant to provide consultancy services to the program, and to support capacity development of the DOI and the WUA. The ultimate aim of the IMTP was to transfer the O&M responsibility and/or ownership of the schemes in accordance with the farmers' capacity to mobilize local resources.

It was planned to implement the program in two phases over a period of seven years (1995-2002). In the first phase, three systems, namely the Khageri (3900 ha), Panchakanya (600 ha) and the West Gandak (10300 ha) were selected. No reasons are given for their selection in the first phase, but discussions with DOI officials and the consultants involved show that their selection was based on the previous levels of institutional development, water supply conditions and topographic location. In both West Gandak and Khageri, the WUA formation and its capacity development were already taking place since 1992 and farmers were already engaged in canal operation and maintenance activities. Besides, Gandak was a water-abundant system, with apparently no limit to water supply at the source thoughout the year.

Khageri and Panchakanya were selected because of their relatively simple water control structures, and because the farmers in the area are known to be innovative. The government was expecting rapid institutional change in these two systems so that they could be models for other systems Panchakanya was specially selected because of its smaller size and its previous history: It was developed by the farmers and was a FMIS before agency intervention in 1974. Another reason for their selection was that both are relatively water-scarce systems with opportunities for improvement through collective action.

3.5 The Framework of IMTP Implementation

The project framework for implementing the IMTP as adopted by the DOI is shown in Figure 3.2.

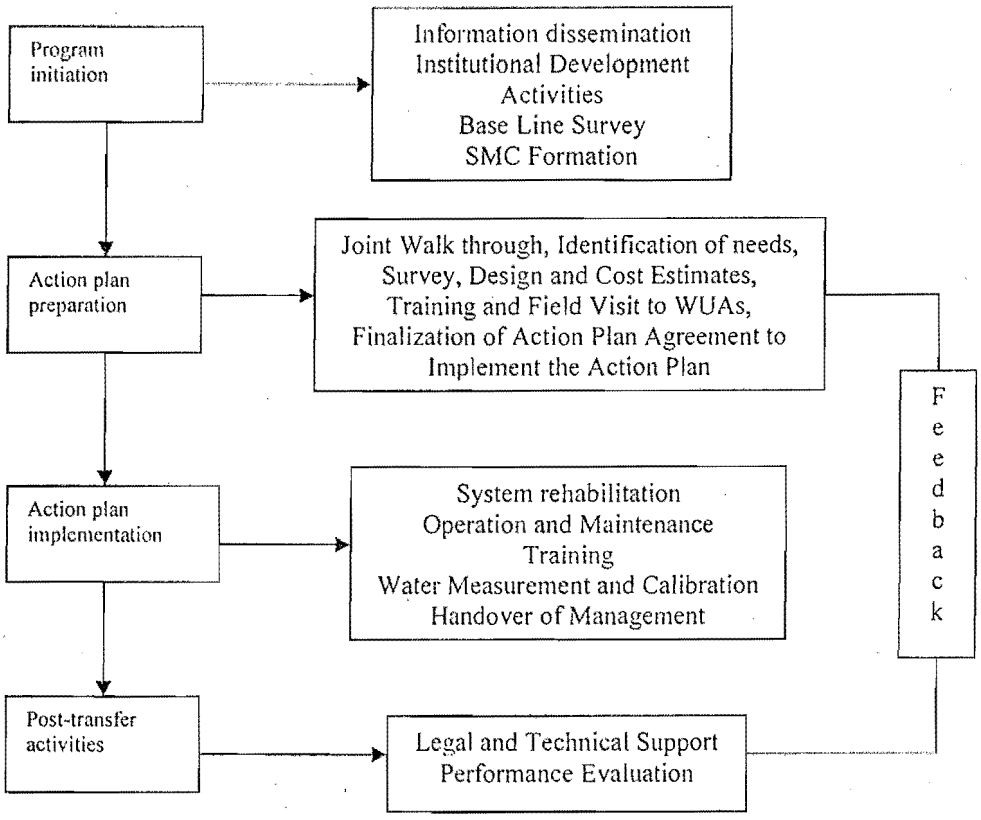

Figure 3.2 Project framework for IMTP implementation

The framework shows a top-down approach to designing and implementing policy reform. Farmers were not involved in the policy reform nor were they informed about the policy reform. The reform itself wasn't demand driven and was induced by the government. Farmers were told by the DOI that they have to participate in the reform.

The process has been developed on the basis of experiences from previous participatory intervention programs like IMP, ILC and ISP. It consists of four stages: the program initiation and institutional development phase; the action plan preparation phase; the action plan implementation phase; and post-turnover support phase (ADB, 1995). The action plan forms the basis of program implementation. It specifies the activities to be carried out during implementation, and the roles and responsibilities of different parties involved in the process.

As seen from this framework, the IMT process mainly involves the formation of the WUA and further support to them through participatory design innovations. It also requires new arrangements between the government and the WUA for the system management. It is influenced by the idea of designing irrigation policy to create conditions under which desired institutions would successfully emerge, for example that would ensure functional infrastructure,

debate type and size of organization and allow user involvement at all stages and levels of project implementation.

The program design also directs all aspects of water control: the organizational, technical and the socio-political. The major focus of the program is on the organizational component, where a multi-tier WUA depending upon the size and technical complexity of the system would be formed. This would be trained and provided with the necessary legal and technical support to carry out the management activities. The rehabilitation is a technical intervention, but its objective is to facilitate the new organization by providing better working conditions for farmers, with technology compatible with their management. The handing over of the system management with new laws and rules and regulations and conditions under which they can operate brings a new socio-political environment to the irrigation system. However, the means to enable complementary evolution of these elements were not really defined. Rather they were just expected to develop through the different phases defined for project implementation of the IMTP, as outlined in the following sections.

Initial Organizational Phase: The process begins with the formation of the WUA matching with the hydraulic boundary and structural complexity of the system. An introductory workshop is organized to explain the process and discuss with farmers, the objective and processes of management transfer. The structure of the WUA is finalized after several rounds of discussions with the farmers, to make the organization relevant to the prevailing socio-technical complexity. The constitution of the WUA is also drafted in parallel with the WUA formation. The WUA is finally brought into being through democratic elections, and registered with the District Water Resources Committee. Agency personnel, which generally includes a sociologist, engineer and consultant play a facilitating role in organizing these activities. The team carries out its activities through the Farmers Organizers (FOs) who are selected from the farmers' community on the recommendation of concerned farmer groups. Necessary training to the FOs and the newly developed WUAs is also carried out. The role of the FO is to prepare baseline data of the system such as household details, irrigated area, and problems in water delivery. They act as an intermediary between the irrigation agency and the farmers at the initial stage of WUA formation. Once the WUAs are registered, the FOs are discharged.

Parallel with WUA formation and capacity development activities, appropriate project orientation courses and training programs are also conducted for the agency personnel involved in these implementation activities. The objective of this training is to ensure people understand the project's guidelines and procedures, and are committed to attaining the project's goals and objectives. After completion of WUA development activities and the training of agency personnel, a Sub-project Management Committee (SMC) is formed. The SMC is chaired by the project manager concerned, and includes the officers of the WUA Executive Committee. The SMC is responsible for the implementation of the project activities ahead. The idea of involving the SMC is to make activities transparent to the farmers and to involve them in the decision making processes, and also to coordinate between the WUA, farmers and the implementing agency staff.

Action Plan Preparation Phase: The second phase of activities includes the preparation of an action plan and agreement over it. DOI technical staff, together with WUA functionaries, carries out several diagnostic walkthrough activities along the entire system, to identify problems obstructing the smooth functioning of the system. The results of this joint walkthrough are then prioritized under five different headings: emergency maintenance; essential structural maintenance; deferred maintenance; catch-up maintenance and system improvement works. Tentative designs and estimates of structural improvement works are prepared, and possible user contribution is also discussed. With the completion of these surveys and activities, the plan of action is prepared jointly by the WUA and respective project staff. The plan will describe the elements of technical improvement activities and institutional development activities. It thus includes: additional training to be provided to the WUA and farmers groups; rehabilitation and improvement works to be carried out with cost-estimates; the cost sharing agreement between the DOI and the WUA; the WUA's plan to raise its const share; and the responsibilities of both the DOI and WUA during the implementation.

After the preparation of the Action Plan, a Memorandum of Agreement (MOA) is prepared and finalized by the DOI staff and WUA representatives. The MOA will also specify: I) the bench mark indicators that must be satisfied before rehabilitation and improvement work can be undertaken; II) procurement, disbursement and quality-control procedures to be followed in connection with rehabilitation and improvement work; III) record-keeping and resource mobilization responsibilities of the WUA; IV) conditions for transfer of O&M and or ownership transfer to the WUA; V) the scope of transfer contemplated (including the case of ownership transfer, precise description of the facilities, land and equipment to be transferred and VI) ongoing rights and responsibilities of DOI and WUA. The MOA is then signed, which opens the path for further program implementation. Implementation of the Action Plan: The third stage is the implementation phase, where the action plan conceived and agreed by concerned irrigation agency and the WUA is implemented. It thus includes both physical rehabilitation activities, and strengthening the WUA through training and field-visit programs. It begins with detailed design and cost estimates of the elements identified during the action plan preparation phase. These activities are carried out in close co-ordination with the respective WUA or farmers groups. Any changes from the previous study are accommodated here and user contributions are negotiated again. Once the detailed design is over, tendering and awarding of construction contracts is carried out. Such a contract is awarded to either the WUA itself, or a contractor depending upon the WUA priority. Under the financial regulation WUAs are also allowed to execute the construction work if the construction cost does not exceeded 1.5 million rupees ($20,000) and the WUAs can mobilize the workforce. Among different types of construction work emergency work is carried out first. The remaining works are to be carried out step wise with the implementation linked with the institutional development of the WUA. The construction may take to two five years depending on the complexities of the physical work.

The construction is jointly monitored by the SMC, DOI and the WUA to ensure the quality of construction. Regular meetings between the DOI staff and the WUA initiated through the SMC are held to discuss and assess the progress of the work, to agree on any change/revision on the

design or manner of undertaking the work, and to reconcile records of individual farmer contributions and project expenditure. Once the construction is complete for a particular contract, the WUA and DOI staff will run tests, review the work and correct the deficiencies noted during these tests.

Parallel with the construction activities, various types of capacity development programs for the WUA are organized by the DOI, as mentioned in the action plan. Such training is mostly on construction quality control, leadership development, canal O&M and resource mobilization. Such training is directed at different levels of WUAs such as the main committee and the branch committee. Field visit programs to successfully running FMIS are organized. The WUA will also, with support from the DOI prepare and test the O&M plan it intends to implement after taking over management responsibility. Actual progress depends in project supports and vision, as will be shown in later chapters.

Upon completion of the foreseen structural improvement and institutional activities stated in the MOA, O&M responsibility and / or ownership of the irrigation system, as specified in the MOA, is transferred to the respective WUA. At this stage, farmers are required to carry out the agreed post-turnover activities. The DOI will provide the WUA with appropriate evidence of the transfer and shall take all other necessary steps to make the transfer effective. The role of the agency at this stage is limited to providing technical and back-up support.

Post-Transfer Activities: After the transfer of management responsibility to the WUA, the government's other job is to establish effective monitoring and evaluation, besides providing other technical support to the WUA. The necessary data and feedback for this should be provided by the WUA. Further training programs to the WUA also continues as demanded by the WUA. The government will continue to provide technical assistance, and if required provide financial assistance in the case of system damage from natural disasters. If the system is under joint management, the O&M responsibility for the main canal and the head work remains with the government, and they are required to perform management activities at these levels in co-ordination with the WUA.

3.6 The Organizational Structure of Project Implementation

There were two levels of authority in the project execution: field level and central level. The field level actors included the project staff of the concerned irrigating offices, the WUA and the external consultant's deployed in for the IMTP. The concerned field offices were responsible for the implementation of the project. For Khageri and Panchakanya, the Narayani Lift Irrigation Office (NLIO) was responsible for implementation whereas West Gandak had its own separate project office. Both these offices were headed by senior engineers of the DOI.

At the central level, there was a co-ordinating office headed by a project co - ordinator to supervise the implementation of the field was responsible for dealing with both the donor agencies in getting funds released and furnishing project progress. S/he was also responsible for carrying training and other capacity development activities to the WUA in the field upon request from the field-level project offices. S/he was personally committed towards participatory approaches in irrigation management. The co-ordinator was supported by the System

Management Branch (SMB), Research and Technology Development Branch (RTDB) and the Human Resources Development and Training Branch (HRDTB) of the IMD in excuting the activities. The co-ordinator was again accountable to the Deputy Director General (DDG) of the Irrigation Department looking after the Irrigation Management Division (IMD). The DDG of the IMD was also the project director of the IMTP, but was not responsible for everyday project execution. His job was to oversee the overall implementation. The actors at the central level were at higher position in the DOI bureaucracy as compared to the field level project managers.

Consultancy to the project was provided by the Colorado-based American company Computer Aided Design Inc. (CADI). The consultants included an American expert and three local professionals: two irrigation management experts and an institutional development specialist. The consultants worked for both field and central level project authorities. Two local professionals, the institutional development specialist and one management expert (previously with HRDTB) were based in Chitawan to assist all three systems where management reform were being implemented at first stage. The remaining two consultants (one American and one local) were based in Kathmandu to assist the central coordinating office. In addition, a few professionals (both local and foreign) were hired for a limited period for specific services as required.

The consultants worked as an independent team, and were not involved in daily implementation of the IMTP. In this way, they were not dominating and dictating in the project activities. However their role was also not clear. They were mostly engaged in preparing evaluation reports, supporting WUA establishment and providing advice when asked by the field level office.

Besides these irrigation institutions, two other important agencies were involved in the implementation: the USAID and the ADB, but not at field level. The ADB was mostly concerned with the physical progress of the project. There was one mission visit every year from Manila to review the project progress. There were also other several political and administrative institutions who were involved directly or indirectly in the process including the Ministry of Finance (MOF), the National Planning Commission (NPC), the office of the Auditor General, the Village Development Committees (VDCs), the District Development Committees (DDCs), and District Administration Office (DAO). They had a limited but important role in the process as will be seen in the ensuing chapters. The MOF is responsible for releasing the funds annually and the NPC is responsible for approving annual plans and programs. The Auditor General is responsible for the final auditing of the project expenditure. The VDCs and DDCs are local-level political institutions and the DAO is responsible for the over-all administration of the district. These organizations are always engagted in local-level intervention, although their roles are not specific.

This presentation of the organizational structure shows the multi actor environment of the IMTP. For the field-level implementation offices, the central project office and its supporting units are part of their 'influencing environment'. Likewise, the DDCs, VDCs, and DAO are also as part of their 'influencing environment'. However, the MOF, NPC, USAID, ADB are the elements of

the appreciated environment. However, the actors are not always visible, especially those in the 'appreciated environment'. They can be unpredictable, shifting and highly turbulent.

3.7 Summary on IMT in Nepal and related policies

The IMT program in Nepal is a comprehensive one, trying to address all forms of water control: the technical, organizational and the socio-political. This differs from past efforts to promote participation in water management in several ways. The major difference is the inclusion of the socio-political dimension, with changing rules and regulation to support the new management. Past efforts to promote participation in irrigation were directed to technical intervention and organizational development activities only, like the Command Area Development Project (CADP) of the 1980s. CADP was more focused on on-farm development activities inside the command area. The emphasis on a participatory design process to support new evolutionary organizations is another major difference in current IMT programs. In the past, design implementation was conventionally based on top-down approaches without user involvement. Another major change is in the concept of the organization itself. In the past, local organizations were seen as a unit to complement to the government agencies, co-ordinating in water distribution activities below the outlet level. But now efforts are towards governance change, replacing the government partially or fully depending on the scale of the irrigation systems. At the same time, organizations are being formed at system level without being limited to the outlet level as in the past.

The programs is heavily focused towards technical improvement works to support organizational evolution, but failed to consider the influence of choice of technology in water management. Besides, systems themselves are not always amenable to improvement in water delivery as supposed. In addition, the new laws and regulations give norms without reference to past practices of local water management as they have evolved under complex shifts in local government and agency control, with which new organizations have had to struggle to assert their new roles and rules. Also possible choice of organizational structure, rules and roles are left to be shaped by key external actors and not just the farmers themselves. These strengths and weaknesses help to define the struggles of new organizations and their members, an ephemeral project structure, and old agencies to enable participatory irrigation management.

CHAPTER - IV
ANALYSIS OF FINDINGS OF THE STUDY

4.1 Pancha-kanya Irrigation System

A. Water Availability Situation in PIS

It has been reported that during the implementation of IMTP a number of gauzes had been fixed and calibrated. The discharge flow in the main canal was being regularly measured till 1999. After the system was handed over to the users the discharge measurement became irregular. At the present state gauzes fixed at some of the discharge measurement spots were found missing and the paint marks in some of the gauzes were not readable. The discharge measurement record, as shown in Table 4.1 indicates that the main canal gets a higher discharge in the range of 966 to 1190 lit/sec during the monsoon paddy cultivation time. During the month of Dec-Jan (Poush), the discharge goes down to about 850 lit/sec and in April (Baisak), it is further down to about 328 lit/sec. During the field survey of this study, discharge was measured at the downstream of headwork using float method and it was observed to be 183 liters per second.

Table 4.1: Discharge Record of PIS

Panchakanya Irrigation System				
Discharge in lit/sec				
S.N.	Canal Operating Month	1997	1998	Average
1.	January	Na	Na	
2.	February	Na	Na	
3.	March	Na	Na	
4.	April	Na	428	428
5.	May	Na	746	746
6.	June	Na	1042	1042
7.	July	966	1112	1039
8.	August	1120		1120
9.	September	1190		1190
10.	October	Na		-
11.	November	Na		-
12.	December	850		850

Source: Semi Annual Report no. 8, IMD

The group discussion with the different farmers' group and discussion with the main and branch committee revealed that the water at source has reduced significantly due to encroachment and increased settlement at the catchment of the Panchakanya River. The beneficiaries of Pancha Kanya Irrigation System (PIS) are worried and concerned over the reduction of the water supply at the source. The problem seemed much aggravated due to the contractual arrangement awarded by Ratna Nagar Municipality to individuals for fishery. There have been conflicts reported between the beneficiaries of PIS and the Municipality regarding the award of such contracts. Though Local Governance Act gives authority to municipalities to make use of resources within

their political boundaries, it doesn't bind the municipality to protect and preserve the natural resources like water in the catchment which is being beneficially used for irrigation or other purposes for other group of users. Although source acquisition and protection are prime task of WUA, they are ill defined by the existing legal frame work. The National Code of 1963, the Water Resources Act of 1992 and the Water Resources Regulation 1993 (WRR) stipulates the use of right of their water source by the PIS irrigators. However, the catchment isn't considered an integral part of the PIS in institutional terms. The WRR fails to cover rights over the catchment areas of water sources. In the sense WUA and DOI have no jurisdiction over land and water uses upstream of the head work.

The catchment in PIS has been subjected to intense environmental pressure with adverse effects on water availability to PIS. In the immediate vicinity of the pond and the springs and streamlets leading to the pond, which is the source of water for PIS, settlement and agricultural activity are prevalent. Fish ponds have been established and divert water from the main pond. The formally wooded catchment is almost totally devoid of tree cover and new land has been opened for settlement and agricultural cultivation. Agricultural fields have been established in the immediate pond area using surface irrigation from springs and streamlets. The net effect of these developments caused the increased runoff and decreased recharge of ground water sources feeding the springs. This has decreases the dry season flow. All these adverse effects are observed and experienced by PIS farmers. Given the rate at which the supply of irrigation water is reduced over the years, the sustainability of the irrigated agriculture of PIS is under question.

Despite these, the study of secondary information as well as the discussion with the farmer' group revealed that only fraction of intended command area of the PIS system were receiving irrigation facility in the past years due to the substantial water leakage along the canal conveyance system and poor water management system. In the past years, the command area of PIS was estimated around 300 hectares and about 72 percent of command area used to receive irrigation during monsoon season. Likewise, the estimation of irrigation availability in winter season was reported to be about 60 percent and while that in spring season to be about 17 percent. It was reported during the field survey that the tail-end branches such as BC-7 and BC-8 are not receiving water at all during winter and spring seasons.

The farm survey of PIS revealed that 67% of the farmers feel that there is better water availability in monsoon and winter seasons compared to the water availability prior to IMTP. Specifically the tail end farmers are happy over the water availability. It has been reported that the tail end farmers are now getting water for monsoon paddy crop after IMTP where they were cultivating dry foot crops like maize prior to IMTP. Though water is still scarce in the system, farmers felt that they get water equitably and in their turn. For such improvement they give credit to the canal improvement works like lining and the better water allocation and distribution system adopted after the IMTP. The responses obtained through questionnaire from farmers of PIS, KIS and NWGIS have been given in summarized form in Annexes 4.1 (a),4.1(b) and 4.1(c) respectively.

B. Irrigation Water Allocation and Distribution in PIS

Allocation of water by the WUA is primarily for irrigation use. Other uses, such as supply for fish ponds are considered only after sufficient water has been supplied for irrigators. Given the scarcity situation in PIS, multiple water uses are currently of little concern. The main canal committee allocates water to the branch canals according to the aggregate demand by the farmers which is registered by the branch committees. Principally the basis for allocation to farmers is the share system which entitles them to supply according to the size of their land. Second criterion for allocation is the crop type. The branch committees forward a cropping plan with a relevant demand data to the main committee, which then designs a rotation schedule of supplies to regulate the distribution of supplies to branch canal. The water delivery staff monitors the implementation of the rotation schedule. In principle allocations to individual users are made only if the requisite irrigation service fees are paid. Water entitlements can not be traded branch canals or individuals. Particularly farmers from the mid and tail reaches depend on pumped groundwater to secure a viable crop. Irrigation from tube and open well is individualized and the WUA is not involved in organizing and regulating water. The availability of irrigation water and demand influence the allocation schedule. As supplies decline and demand increases, the time between the scheduled turns increases. Thus far the irrigators have not been excluded from registering their demand due to scarcity. Farmers reported, however, that interval between irrigation turns extended up to two weeks or even a month which may expose their crop to moisture stress even in lower lying fields with high water retention capacity.

Distribution within branch canal is less rationalized and regularized. The chair person of the branch canal committee fixes a tentative schedule on the basis of mutual understanding among irrigators in each branch canal. No formal schedule exists. Irrigators take turns as they need and conflict between head middle and tail is more frequent. Despite the distribution of water has improved in the system compared to the scenario prior to IMTP, conflicts are prevalent primarily due to scarcity of water. Mediation is one of the major tasks of the branch committee members. Also the farmers beyond the reach of channels are allowed to receive water although they have not dug proper extension of the current channels. Thus, considerable water losses would occur. It was learnt that WUA main committee allows water to such farmers with a view of generating more income and hence is liberal in allocating new water shares. There was a considerable complaint among the irrigators interviewed at the middle and tail reaches of PIS about the insufficiency of the turns.

It is learned during recent PRA that entire command area measuring about 600 ha of land were provided with irrigation facility for the rice crop last monsoon season. The WUA executives explained that it was possible because of water saving from leakage along canals after accomplishing the repair/ maintenance works under system improvement program as well as improved water distribution system adopted by the WUA. The secretary of the WUA was pointing to the fact that the farmers from the tail-end Branch (BC-8) received water for the first time for their rice crop during last season. IMTP intervention has increased the water availability to the irrigators. This is evident by the fact that spring rice cultivation in the command area in

BC-2 alone has increased and 42 ha of land has come into early rice plantation which is solely due to the timely cleaning and repair/maintenance of canal system.

Though the water delivery and distribution in spring season has improved, the farmers have to pump water from wells dug near by the canal to supplement the irrigation water requirement of the crop. It was reported during the survey that farmer have to rely on pumped water even in monsoon and winter in case there isn't timely rain or water at the source is quite low.

It is found that the establishment of O & M plan which was developed by the IMD staff earlier along with the IMTP consultants for the WUA has helped the WUA in scheduling the available water. There are documents with needed field information along with guidance on personnel requirement to perform the tasks. The establishment of Canal Management Workforce, who would perform the task of O & M in their respective branch or sub-branch, has also helped the WUA and farmers in managing the O & M of the system. The some discharge measuring gauges are present along the main canal off takes, which the farmers have been using for measuring the water allotment to respective branches.

Based on the information gathered from PRAs and household survey information, there has been marked improvement in water schedule development and implementation. The farmers are satisfied with the prevailing system of water distribution. The farm survey of the study reveals that 85% of the farmers feel that the reliability of irrigation supply has improved after IMTP compared to the situation prior to IMTP and 77% of the farmers expressed that the distribution of irrigation water is better now compared to the situation prior to IMTP.

After the physical improvement of the canals, farmers were attracted to the cultivation of spring paddy in PIS. As more and more farmer opted for spring paddy, and WUA also encouraged this with a view to increase the ISF, the adequacy of the irrigation water was severely affected as the scarce water available at the source has been the cause for concern. For that reason, the WUA has to put much effort during the water distribution for this crop. It was revealed that, at times, the schedule for water distribution went as wide as 15 days apart so that the standing crop could be saved from crop failure due to drought. The WUA has mandated the farmers to get approval in advance from WUA so that the latter can come up with possible water scheduling.

In order to compensate the comparatively lower discharge available for tail reach farmers, there exists a differential time allotment. For example, the water allocation schedule at the rate of 9 minute per katha at head reach and 12 minutes per katha at tail reach was being observed at some periods.

The study however reveals that the tail reach farmers still face problem of water stealing and breaching of canals. For example, in the BC 1, the tail reach farmers have to watch constantly the upper reaches to get water in their fields even during their turns. When it comes to water allocation in rotation at different branches along main canal, there is no problem occurred, but within branches and sub branches, where there are no specific person to watch the water application during the turn as decided, the farmers themselves sometimes, steal other's turn. At the time of water scarcity, even when the WUA puts forward a tight water distribution schedule, there exist some amount of problems at field level.

C. Actual irrigated area in dry and wet seasons in PIS

Table 4.2 presents the status of actual irrigated areas in dry and wet seasons in PIS during the past years. Considering the comparison of before and after turnover in July 1997, the data indicate that there has not been evident increment in irrigated area from 1995 to 1997. However, the record shows that the irrigated area has increased up to 600 ha by 1999. This raises doubt over the reported command area. The WUA of PIS claims that the system has been able to irrigate 450 ha of area in monsoon season. One of the reasons for such higher reporting of irrigated area can be attributed to the fact that WUA of PIS wanted to incorporate all the users within the reported total command area of the system and hence took all the area as irrigated area. Some of the low land lying within the command area of PIS are also taken as the irrigated command area of the system though these areas do not irrigate directly from the canal system rather they get the drain water of the canal system. The farmers from the area are neither the member nor the shareholder of the system. The WUA of PIS wants to incorporate those farmers within the institution on the ground that they are ultimately getting benefit of the improved canal system. It is also important to mention here that at present state not all the area of 600 ha gets irrigation water reliably and up to the requirement even for the wet season. Farmers take water as much as they can get from the irrigation system and they provide supplement irrigation by pumping ground water or rely on natural rain.

The irrigated area has decreased for dry season by 2002 compared to the time when the system was turned over to the farmers. The farm survey of this study revealed that there is slight (5 %) decrease in the irrigated area of land despite the general sense of better distribution and water availability after the IMTP. The decrease in the irrigated area is mainly due to the increased cost of pumping ground water and other cost of production specifically for spring paddy cultivation. The farmers of PIS reported that they prefer dry foot crops (wheat, maize and lintel) for winter and spring season mainly due to the low cost of production of these crops.

Table No. 4.2: Irrigated Areas in Dry and Wet Seasons at PIS

	Season	1995	1996	1997	1998	1999	2000	2001	2002
Panchakanya	Wet	450	-	440	442	600*	600*	600*	600*
	Dry	200	-	259	259	164	150	133	120

Source: SAPR 2,3,4,6, Project Offices, WUA records and field survey

* The irrigated area of 600 doesn't get reliable supply of irrigation water from PIS and includes all the gross area.

Table 4.3 shows the crop coverage in PIS in the past years. It has been reported that, except for the early paddy, the changes in the crop coverage are not linked with the increased water availability or improvements due to IMTP intervention.

Table No. 4.3: Crop Coverage in PIS during Last Five Years

	1995	1996	1997	1998	1999	2000	2001	2002
Paddy	381	471	440	400	600*	600*	600*	600*
Early Paddy	106	108	129	30	100	100	125	100
Wheat	32	175	200	5	-	50	60	50
Oilseeds	170	170	60	Na	50	15	25	40
Pulses	157	175	100	300	250	200	150	200
Maize	177	Na	200	26	100	60	50	75

Source: IMTP semi-annual benefit and impact evaluation report no 6 (Sept. 1999), WUA records and field survey

D. Condition of Physical System and its Maintenance

During the joint management phase of IMTP an action plan indicating needed system rehabilitation work was designed between farmers and the DOI. The water users' contribution in terms of labor was approximately 26% of the total cost. The government of Nepal and ADB funded the remainder. Activities were planned and implemented jointly. WUA representatives were involved in awarding the contracts and supervision of the works. The discussion with the branch and committee members and the focus group reflected that the reasonable quality of work was ensured and funds were spent properly. The study team also verified these claims by having observation of the rehabilitation works and found those claims quite correct despite some damages were observed due to lack of proper maintenance after the system was turned over to the users. The farmers accepted that the rehabilitation works were incomplete at the time of transfer. As per the farmers and their representatives, all the money allocated under the item of rehabilitation works was used to construct the lining in the main canal upstream of the highway. Though the farmers and the DOI had agreed to carry out a number of rehabilitation works, they couldn't be completed because of budgetary constraints under IMTP. The major reason for incomplete construction was the amount that farmer had to contribute in the construction. The rehabilitation works mainly required the structural improvement that demands materials and skilled labor ultimately demanding more resources. Farmers of PIS were not willing and able to pay a huge contribution of 26% of the construction cost. Hence there a compromise had been made between the agency and the farmers limiting the works as well as contribution from the farmers. However the activities listed in the action plan was completed before handing over the responsibility of management to the farmers with the total cost of rehabilitation being Rs 6.2 Million out of which farmers had contributed about Rs. 1.1 Million. The details of the cost of rehabilitation in PIS under IMTP are given in Annex 4.2 (a).

Regarding the quality of works, the work of lining in the main canal was found excellent but repairing of gates was incomplete and the issue of the catchment protection is yet to be tackled. The WUA was able to secure financial support of NRs 141000 for post transfer rehabilitation and corrective works. Some repair and maintenance works have been carried out by WUA even after the turnover with the WUA's own resources and the support from DOI. It is reported that about Rs. 124,000 has been spent by the WUA for construction of new gates, canal lining, desiltation, repair/maintenance of underground hume-pipelines, regulators, outlet gates and other structures. Likewise, the farmers in different branches have done some 1200 man-days worth of desilting works.

It has been learnt that DOI had made a commitment to support the WUA to complete the unfinished rehabilitation works. The farmers expect that DOI should honor its commitment and provide farmers an intact system. They also reported that the system is not able to generate resources enough to meet the operation and maintenance requirement as it is not able to serve the farmers with adequate and reliable irrigation water supply. Farmers interviewed were of the view that they would be able to cover the cost if system was capable of performing at close to optimal level. The conditions for high performance were identified at first; the completion of rehabilitation works and secondly the protection of system catchment.

The household survey as well as PRA sessions in this system revealed that almost all the respondents replied that there has been evident improvement in the physical state of the canal system. The farm survey revealed that nearly 95% of the respondents were happy over the condition of canal condition and its maintenance compared to the state prior to IMTP. Similarly 82% of the farmers responded that quality of canal maintenance and supervision is better compared to the state before IMTP. They also reported that there has been decrease in leakage and seepage from the canal from more than 50 percent to some 25-30 percent now. After the transfer of management, the WUA and farmers as well seemed to be more aware of the state of canal. Now the maintenance activities are more prompt and more frequent. The survey of the farmers revealed that nearly 90 % of the farmers have improved awareness regarding the irrigation management and the role of farmers and WUA in management of irrigation system.

Perhaps the rule to deposit certain amount for maintenance in advance with the main committee is instrumental in generating this awareness. Farmers get refunding at the rate of Rs 100 per day for their labor contribution.

It is however illuminating to hear from the Chairman and Secretary of main committee that the concrete (pucca) gate system is costly for the farmers to repair/maintain. They opined that some simpler structure would be more appropriate in their situation (they are referring the structures as constructed in Chhatis-mauja irrigation system).

E. Agricultural Status in PIS

The discussion with the farmers' groups revealed that the cultivation of spring paddy (chaite dhan) had increased in the initial years of IMTP partly due to increased water availability resulting from well-maintained canal system as well as adoption of a better water distribution arrangement. The structural improvement activity before the system transfer has been instrumental in mitigating the leakage of water from canal system. Also, the enforcement of a water distribution schedule by WUA has also contributed in relatively equitable and reliable water supply to the cropped areas. As more and more farmer opted for spring paddy, the adequacy and reliability of the supply of irrigation was adversely affected. With the increased irrigated area of spring paddy in the system, farmers had to spend more on ground water pumping to save the crops. Hence the irrigated area of spring paddy got decreased over the time. The variety for the spring paddy used was CH-45 which was said to be introduced in the command area from fellow farmers of Devnagar in Western Chitwan.

Spring paddy yields around 3 t/ha under moderate water availability condition although better production can be achieved if sufficient irrigation is available. It is reported that the yield of the crops had increased at the beginning (around 1997) up to 3.75 t/ha but is has now decreased up to 3.5 t/ha on average. Such decrease is partly attributed to decrease in water availability over the years and also due to less application of fertilizers. It has been also reported that there is a substantial sale of spring paddy in the local market thus improving the financial status of the farming families.

It is obvious that one of the visible impacts of the increased cultivation of spring paddy could be felt on the general concern of the farmers and WUA in O & M of the irrigation system. Besides,

there is another interesting impact of the same promotion of spring paddy cultivation in the command area, which is the rise of use in tractor for land preparation. As the hiring of tractor became more customary, the purchase of tractors by some farmers has also increased. This has further led to increased cost of cultivation.

The yield of monsoon paddy is also reported to have risen after improved water distribution arrangement. With good water supply, farmers get a yield of 4 t/ha for Mansuli and Savitri varieties, which are grown during monsoon season. It is reported that there has been slight increase in the production of maize also. The average yield of maize in summer is around 1 t/ha.

The data of the study also shows that the sale of lentil is also in the increasing trend. The answer to the increased production and sales of maize and lentil from the command area could be found not only from the better water management activities of the irrigation system but also from the cultivation extension activities. No significant improvements have been observed in the yield of major crops in PIS rather decrease in paddy, early paddy and wheat has been observed since 1999. Such decrease in yield is mainly attributed to less application of fertilizer and cultivation of crops under same cropping pattern over the years.

E-1. Crops and Crop Varieties in PIS

In PIS command area, paddy and wheat are grown by majority of the farmers. Table 4.4 shows the crops and their varieties grown in the command area of PIS. Mansuli is dominating variety in rice followed by Savitri. Farmers consider Mansuli rice as strong variety with strong stem, which can withstand wind and does not lodge easily. In wheat crop NL297 and NL251 varieties are common. During winter season lentil and mustard are grown in the areas as the crops demand less irrigation water and can grow with less soil moisture.

Table No. 4.4: Crops and Their Varieties Grown in PIS

S.N.	Crops	Varieties
1.	Paddy	Mansuli, Sabitri, Jhapali, Swarna, Kalinga, Basmati
2.	Wheat	NL 251, 297
3.	Lentil	Local
4.	Mustard	Local
5.	Vegetable	Hybrid cabbage, cauliflower
6.	Potato	Cardinal, MS 42, Kufrijyoti
7.	Early rice	CH 45
8.	Spring Maize	Rampur Composite, Arun-2, Sathiya Indian varieties- Megha, Surya, Kanchan

Source: Field Survey, IOE, May. 2003.

Winter vegetable and potatoes are found to be grown by relatively less number of farmers. CH-45 is the main early rise variety grown in the PIS command area. Growing maize varieties of both of short and long duration (Rampur composite and (Arun-2) Rampur yellow) are common. Some farmers have introduced improved maize variety such as Megha, Surya and Kanchan.

E-2. Cropping Pattern and Intensity

The cropping pattern differed in PIS from one area to another depending upon irrigation water availability, soil type and farmers' preference. Water from the canal is not available to the farmers of PIS tail area for winter and spring season crops. Although BC-1 is located near the

canal head, the available water is not adequate for growing rice due to sandy loam type of soil, which requires frequent irrigation. The crop cannot wait for a turn of 7 day rotation. The crop gets dried by the time the turn for irrigation comes. Cultivation of spring paddy is done wherever irrigation is available thus building a cropping pattern of Paddy – a winter crop of either wheat or lentil or mustard-early paddy. Some farmers skip winter crop and grow only two crops of rice making a cropping pattern of **paddy – fallow – early paddy** is also found. Usually, maize is grown as third crop in water deficit areas. The early paddy grown in the head reach depends mainly on the pumped ground water to meet the irrigation requirement. The major cropping patterns followed in PIS command area are presented in Table 4.5 below.

The overall intensity for PIS command area is calculated as 205 percent. Table no 4.5 shows the cropping intensities for different canal system of head, middle and tail. It has been reported that the cropping intensity hasn't changed much compared to the situation prior to IMTP that was reported to be 200% in 1995.

Table No. 4.5: Cropping Intensity and Yield in PIS

Different Reach of Irrigation System	Cropping Intensity (%)	Yield in (Kg/ha)								
		Summer paddy	Spring paddy	Wheat	Summer maize	Spring maize	Lentil	Potato	Mustard	Winter vegetables
Head	235	3469	2793	3240	1786	1511	376	7500	434	11750
Middle	210	3842	3124	2183		1557	706			7500
Tail	172	3161	4367		1500	1500	410		745	
Grand Average	205	3512	3428	1808	1643	1523	498	7500	590	9625

Source: Field Survey, IOE, May 2003.

The cropped areas of different crops are reported to vary over the years depending on the water availability as well as the economics of crop cultivation. Except in some of the areas (tail end) where monsoon paddy has been cultivated and practice of early paddy cultivation increased there hasn't been any evident change in the cropping pattern with IMTP intervention.

E-3. Crop Yields in PIS

Table no 4.5 also shows the yields of crops for different branches of head, middle and tail. It is to be understood that the crop yield is the output of quality seeds, optimum use of inputs (chemical fertilizer, irrigation) and timely farming practices. In some cases the crop yield has gone down due to less application of fertilizer and also due to excess soil moisture. In tail portion of PIS (Ward No 7) the soil is mostly the clay mixed, which clots when water dries, reducing the aeration in root zone eventually declining the crop productivity.

The crop yield reported is relatively higher compared to district and national average for paddy, wheat and potato, which have maintained the level of 3-4 years ago. It is understood that the farmers have their own way of selecting seeds for the next year. For maize crop the yield level is rather low as compared to the farmers' experience of 3 - 4 years ago. In maize it is rather difficult to accurately measure the output as they are consumed as green cobs in the area. Table 4.6 shows the comparison of yields of major crops before IMTP (1995) and after IMTP (2002). It shows that the cropped areas for all the major crops except late paddy and lentil have

decreased compared to the scenario prior to IMTP. The significant increase in the cropped area of late paddy is the major impact observed after IMTP. This is mainly due to the increased reliability of water for the monsoon season. No significant changes have been observed in the yield of major crops except in case of wheat and maize rather the productivity has slightly decreased for the main crop paddy. The productivity of mustard and lentil reported to have decreased in recent years.

Table 4.6 Yield and cropped areas of major crops in PIS before and after IMTP

Crop	Area before IMTP (ha)	Area after IMTP (ha)	Yield before IMTP(kg/ha)	Yield after IMTP (kg/ha)
Paddy	381	400	3641	3512
Early Paddy	106	100	3443	3428
Wheat	175	50	1600	1808
Summer Maize	175	75	1664	1643
Spring Maize	10	15	1794	1523
Pulses (lentil)	150	200	0.642	498
Oilseed	170	40	0.71	590

Source: Base Line Study of Panchakanya Irrigation System, ICON 1995 and Field Survey, IOE 2003

E-4. Fertilizer Application

Most of the farmers in PIS command area are found to be aware of using chemical fertilizer and improved seeds, but they have little idea about insecticides and pesticides. Almost all the sample farmers reported to have applied urea in paddy, early paddy and wheat crops. However, only 60 percent reported the use of DAP. The farmers from the PIS are using higher dose of urea than recommended. Farmers reported that as the use of compost fertilizer (green manure) has significantly reduced over the years they have gone for higher dose of urea in late and early paddy. Table no 4.6 presents the chemical fertilizer application for some major crops.

Table No. 4.6a Chemical Fertilizer Application by Crops in PIS Command Area

(Unit: Kg/ha.)

S.N.	Crops	Type of Chemical Fertilizer		
		Urea	DAP	Potash
1.	Paddy	119 (100)	105 (100)	20 (30)
2.	Early Paddy	112 (100)	105 (100)	15 (30)
3.	Spring Maize	30	30	0

Source: Field Survey, IOE, May, 2003. The figures given in the parenthesis are the recommended dose.

The survey and the focus group discussion of the farmers revealed that there has been significant increase of about 15% in application of chemical fertilizers after the IMTP. The application of urea and DAP is higher than the recommended dose. Despite the increase in the application of chemical fertilizers no significant change in the yields of the major crops are observed. The reduction in the yield of major crops over the years is also attributed mainly to the reduced supply of water in quantity over the years and also to the reduced application of green manure as farmers reduced the number of animals after the Chitawan National Park restricted the farmers to get fodders from jungle for their domestic animals.

E-5. Extension Activities in PIS

The PIS command area is served by Agricultural Service center (ASC) of Bakular,Ratna Nagar Municipality, which provide agricultural extension technical services to the farmers. The farmers of BC-1 area learned to have received minikit package like lentil (Sisir variety) and vegetables composite packets (cauliflower and brocauli) from the ASC. However the respondents from the BC 5 and BC 7 reported that they have no contact with JT/JTAs and have not observed any kind of extension activities. It was reported that District Agriculture development Office (DADO) has now adopted group strategy of extension approach providing technical services and messages through farmers' group in the VDC. This approach is different from traditional approach wherein the JT/JTAs visit the farmers in regular basis. Therefore, the individual farmers are required to contact technicians of ASC, if they have any problem. Not many farmers were aware of this fact.

The farmers of surveyed area particularly those of BC-5 and BC-7 reported to have contacted Agro-vet shops whenever, they have disease and insect problem in the crops. LI-BIRD, the local NGO learned to have extended some activities such as seed multiplication of cereal seeds in BC 7 command areas. Farmers in the area have received improved seeds of paddy, wheat, maize, lentil and mustard as minikit packages. Though there has been nominal increment (about 7%) in the number of farmers who have used improved seeds compared to the prior IMTP situation, farmers from the locality are far ahead in terms of adapting the new technology and inputs for agriculture. It was learnt that IMTP intervention has no clear link with the enhancement of extension services to the farmers. Farmers have adopted the agricultural technologies on their own or by following their fellow farmers

E-6. Agricultural Marketing in PIS

Paddy, maize, lentil, early paddy and milk are the major farm products, the farmers sold in the market. The major selling points for such commodities of PIS are Ratna-nagar, Tandi, Narayanghat, etc. No changes were reported in terms of marketing for agricultural products with the intervention of IMTP

E-7. Farm Income

Based on the finding of the household survey, it was found that the majority of the households are depending on agriculture. In addition to consumption of the agricultural products majority of households are selling agricultural products. Livestock is another component, which has a fair share in household income. The household survey results show that 66% of the households sell paddy on top of the production kept for their own consumption. Regarding the source of income in the family, slightly less than one quarter of the income (24.8%) of the farmers in the command area is derived from agricultural related jobs. Most of the agricultural products are used for self consumption. The Table no 4.7 shows the share and magnitude of income sources of both agricultural and non-agricultural activities. Remittance has been reported as one of the major source of income accounting 28% of the total family income on an average.

Table No. 4.7: Income Sources in PIS

S.N.	Income Source	Percentage of Total Income
1.	Sales of Agri Products	17.1
2.	Livestock Products	7.5
3.	Agri Labor	0.2
	Agri Income Sub-total	**24.8**
4.	Service	28.6
5.	Daily Wage Earning	4.2
6.	Shop Keeping	14.1
7.	Skilled Labor	0.3
8.	Remittance	28.0
	Non-agri Sub-total	**75.2**
	Grand Total	**100**

Source: Field Survey, IOE, May 2003

E-8. Net Benefit and Cost of Production

Crop budgets have been calculated for major crops based on information from the key informants. The Table no 4.8 presents the gross return, production cost and net return for major crops. The net return per hectare for monsoon paddy under irrigated condition is calculated to be Rs.7850. The crop variety under consideration was Mansuli, which is grown by majority of the farmers in the command area of PIS. For early paddy crop, the profit is relatively higher which is Rs. 10,639. The spring maize fetched a net benefit of Rs. 6590.

Table 4.8: Costs and Benefits for Different Crops in PIS Command Area (per ha)

S.N.	Item	Gross Return (A)	Production Cost (B)	Net Return [C=(A-B)]	Net Return (without family labor)
1.	Paddy	23952	16102	7850	2970
2.	Wheat	10388	6726	3662	2341
3.	Early Paddy	27350	16711	10639	5839
4.	Spring Maize	16720	10130	6590	2390
5.	Summer Maize	10458	6711	3747	1385
6	Lentil	10000	6470	3550	3130
7	Oilseed	12194	7726	3990	1752

Source: Field Survey, IOE, May, 2003

Please refer Annex 4.4 (a) to 4.4(d) for details about the computation of gross return from and production costs for cultivation of different crops grown in the command area of PIS. Despite the early paddy and spring maize fetch higher net benefit, farmers are not willing to increase their cropped area due to the water scarcity situation in the winter and spring season in PIS.

E-9. Economic evaluation of investment in PIS

The economic evaluation of investment under IMTP has been done by comparing the total net benefit of crop cultivation before and after IMTP and by computing the net benefit of investment against the amount spent on physical and institutional development in the system. Some assumptions have been made regarding the economic evaluation and are as follows.

- The base year for economic evaluation is 2000/2001 i.e. three years after the complete transfer of the system.
- The information on cropped area, cost of production and benefit of production for the different crops cultivated in PIS before IMTP have taken from secondary sources (i.e Baseline Study of Panchakanya Irrigation System, ICON 1995)
- The life period of physical improvement due to rehabilitation of the system is taken to be 25 years.
- The net benefits that would accrue from in the first second and third year after the improvement are taken as 70%, 80% and 100% respectively.
- The cost of O&M in the system for the investment has been taken as zero as the cost of O&M would be borne by WUA as per the agreement of WUA with the government.
- The cost of technical assistance for IMTP and other administrative costs are not taken into consideration in the economic evaluation.
- The costs and net benefits are to be evaluated against different discount rates ranging from 2% to 20%.

Table 4.9 gives the cropped area and net benefits before and after IMTP. The table shows that there is net benefit of crop cultivation after IMTP is higher by NRs 457,420 comparing to that before IMTP. Given the total investment (physical improvement and institutional development) made in PIS of NRs. 7,924,727.0, the return seems not much significant.

Table 4.9 Cropped area and net benefit in PIS before and after IMTP

Crop	Area cropped before IMTP (ha)	Net benefit before IMTP (Rs/ha)	Area cropped after IMTP (ha)	Net benefit after IMTP (Rs/ha)	Total net benefit per year before IMTP	Total net benefit per year after IMTP
Late Paddy	381	10632	450	7850	4050678	4710000
Early Paddy	106	9037	100	10639	957912	1063900
Wheat	175	3254	50	3662	569520	183100
Summer maize	175	4608	75	3747	566685	281025
Spring Maize	10	4608	15	6590	46080	98850
Pulses	150	2791	200	3550	418635	710000
Oilseed	170	3119	40	3930	530145	550200
Total					7139654	7597075

One of the major reasons for such low return on investment is the increase in cost of production of major crops. The discussions made on the previous sections of this report regarding the crop yield and cropping intensity have already revealed that there haven't been much change in yield and cropped area of major crops except the for late paddy which has increased cropped area by

15%. The cropped areas of winter crops and oilseed have significantly reduced after IMTP. Due to the water scarcity in spring season the cropped area for early paddy and spring maize hasn't increased despite the canal system was physically improved. The results clearly show that agricultural agriculture and its economy haven't improved much even after the investment in the system has been made.

The net present value of the cost of investment and that net benefit EIRR under different discount rates are computed as below. The details of computation of net present values of investment and the benefit are given in Annex 4.6 (a).

Discount Rate	NPV of Investment	NPV of Benefit
2	8163651	8644227
4	8490138	7402720
6	8825253	6454575
8	9169118	5721086
10	9521858	5146700
12	9883597	4691750
14	10254460	4327572
16	10634572	4033227
18	11024059	3793239
20	11423044	3596051

And the EIRR computation based on the above net present values comes out to be 1.5% which is far below the expected EIRR from the IMTP intervention.

E-10 Sufficiency/deficit in food and agricultural products

It has been found that almost 95% of the farmers grow paddy sufficient for their self consumption. Out of them 66% of the farmers sell paddy to meet their need of other agricultural or non agricultural commodities. Similarly 92% of the farmers grow maize in surplus and 62% sell maize in the market. About 70% of the farmers grow pulses in sufficient and 31% of them sell pulses in market. Regarding the consumption of oilseed, only 20% of the farmers grow sufficient oilseed to meet their need and rest buy from the market. Similarly only 36% of the farmers grow vegetables sufficient for their consumption of which 13% sell vegetables in the market. Rests buy from market for their consumption. The above data show that the production of the major cereal crops in the system is sufficient to meet the food requirement of the community.

F. WUA status

F-1. Membership

Membership of WUA is a must to all the beneficiaries for having water right and to be an eligible voter and candidate of WUA executive committees. The membership of WUA is called the share membership and distributed to the farmers on the basis of household. Membership fee of Rs 10 per year is levied. (Please bear in mind that the membership fee and criteria and different for Khageri and Nepal Gandak system and they would be dwelt in their respective

paragraphs in following pages). Share numbers are based on the land area and the rate per unit share of one katha is one rupee.

Table 4.10 presents details of membership and share distribution for PIS during 2058/59. There are 898 members and 634 have renewed their membership for the coming year. There are 10212 numbers of shares for only 335.18 ha of land areas. As discussed earlier not all the users of the system are members of WUA and hold share. A part of the command area of PIS is low lying field (ghol) which generally doesn't need water from the canal system as it eventually gets water from the drains which are replenished by drain water from the upland fields. The farmers owning such lands are reluctant to join the institution in the fear that they might have to pay the irrigation fee. The executives of PIS WUA opine that the farmers are eventually benefited from the improvement of canal system of PIS.

From institutional point of view, the PIS is strong and effective in terms sorting out the issues within the system as well as to regular operation and maintenance of the system.

Table 4.10: Membership and Share Distribution Status in PIS

S.N.	Branch or Outlet	Total Members	Renewed Members	Share Holders	Area of Share Distribution in ha	Share nos
1.	Outlet 1	23	13	23	5.51	169
2.	Outlet 2	22	13	22	5.99	182
3.	Outlet 3	16	12	16	7.65	232
4.	Outlet 4	24	22	24	5.57	170
5.	Outlet 5	3	3	3	2.14	65
6.	Outlet 6	14	8	14	2.11	65
7.	Outlet 7	2	1	2	1.05	32
8.	Outlet 8	11	10	11	3.45	106
9.	Outlet 9	16	7	16	8.73	264
10.	Outlet 10	15	8	15	5.24	160
11.	Branch 1a	70	63	70	25.37	767
12.	Branch 1b	110	83	110	50.77	1540
13.	Branch 2	64	58	64	27.43	829
14.	Branch 3	25	10	25	18.48	560
15.	Branch 4	48	37	48	14.01	450
16.	Branch 5	182	140	182	59.83	1827
17.	Branch 6	108	73	108	36.72	1111
18.	Branch 7	61	31	61	22.09	672
19.	Branch 8	84	42	84	33.06	1011
Total		**898**	**634**	**898**	**335.18**	**10212**

Source: WUA Record, IOE, May 2003

It has also reported that not all the irrigation user have taken the share certificate. Also among the users who have taken share, their share holding isn't as per their land holding. Hence, all the area under irrigation hasn't fallen into the share distribution in PIS. It has been reported that the farmers owning the low land areas get water from the drainage or leakage from the irrigated upland hence are reluctant to take the share with the notion that they don't have to pay the irrigation service fee if they don't take the share certificate. Nevertheless they receive water once there is water in the canal.

F-2 Meetings of WUA and other committees in PIS

It was also noticed that there is representation of at least one female member in branch committess and the main committee of WUA in PIS. One of the major factor for their under representation is that, only the landowner can be share holder (voter) of WUA as per the constitution of the WUA and all most all of the shareholders of the system are males. The study team were told that they have/would have very little role in decision making even though they were elected as executives of the committees.

The general assembly meetings and the meetings of WUA main committee have been found being held at scheduled times and frequency. The branch committee's meetings though being irregular are being held time to time to make necessary decisions as and when needed. from

F-3. Resource collection- membership fee, ISF, share distribution fee. Other financial resources.

The WUA has access to various financial resources viz. membership fee, share distribution fee, irrigation service fee (ISF) and others. As stated earlier also, the membership fee of Rs 10 per year is levied. The share distribution fee is charged at the rate of Rs 30 per ha (Rs 1 per katha). The ISF for monsoon paddy & spring paddy is Rs 150 per ha (Rs 100 per bigha) and Rs 75 per ha for wheat or maize (Rs 50 per bigha), Labor fee of Rs 300 per ha (Rs 200 per bigha) are charged. Table no. 4-11 shows the total resources of WUA from 1995/96 to 2001/2002. It can be clearly seen from Table 4.11 that total income of WUA has increased almost six folds in 2001/2002. Of the different fees the ISF and the maintenance fees are two permanent source of the WUA.

The WUA now claims that 450 ha area are under irrigation in monsoon paddy. However only 360 ha (80%) has obtained the share and membership of WUA and of this only 259 ha paid ISF paid for monsoon rice in 2001/2002. This is due to the fact that many farmers who irrigate from drain water not from directly from the canal are reluctant to pay the ISF. Also some of the farmers own the low lying fields in the command area do get benefit from the canal system but are reluctant to join the institution.

Table no. 4.11 Status of ISF collection in PIS (in NRs. 000)

S.N.	Type of fee	1995/1996	1996/1997	1997/1998	1998/1999	1999/2000	2000/2001	2001/2002
1.	Membership/Share Fee	5.45	27.89	15.27	13.43	10.26	10.49	6.24
2.	ISF	12.87	22.07	42.87	51.25	63.09	75.98	81.23
3.	Canal Maintenance	-	-	82.98	74.68	85.08	119.2	124.65
4.	Fines/ Penalties	4.62	-	-	-	15.7	6.17	3.24
5.	Other Sources	10.71	16.33	47.88	67.37	8.00	5.59	5.17
Total		**33.65**	**66.29**	**189.01**	**206.7**	**182.1**	**217.5**	**220.53**

Source: Survey, IOE, May 2003 and WUA Records

It has been reported that the ISF collection and collection of other fees have been quite irregular after 1999(2055/56). It was reported that progress in the collection of ISF fee and other fees was reported to be as high as 90% during the period when the system was handed over to the users. It has been reported that the resources generation of the WUA through collection of the fees has improved gradually. During the discussion with the WUA and farmers groups it was known that the WUA has geared up to increase the ISF collection and generate other resources to meet the O&M requirement of the system. Farmers of the system have reported that they are willing to pay more provided that the adequacy and reliability of irrigation water supply is enhanced. Given the scarcity of water in the system the WUA says that it is not possible to increase the availability of irrigation water with the given condition of the catchment of the Panchakanya River.

Regarding the sharing of resources, the amount collected as share fee is retained by the main committee and the ISF is shared between the branch and main committee in the ratio of 25:75 respectively. Till date all the fee is being collected by the main committee. Also the allocation of resources for maintenance is done with the decision of the main committee. This has restricted the role of branch committees. The Table no. 4.12 shows the collection of ISF collection for different crops grown in 2058/59 in PIS command area. Out of total ISF collected of NRs 80990 the ISF collected from monsoon paddy irrigation is NRs. 65029 and that from early paddy irrigation is NRs.15961.

It was known that some 1.5 lakh of rupees has remained as the balance upto last year (2058/59). It was also known that more than one lakh rupees was spent for maintenance and repair works in the year.

The WUA demands that unless the government brings a new law attaching the ISF with other fees, it is not possible to increase the collection efficiency.

Table 4.12: Collection of ISF

S.N.	Branch or Outlet	Total ISF (NRs)
1	Outlet 1	1919.8
2	Outlet 2	1396.6
3	Outlet 3	1866.4
4	Outlet 4	2195
5	Outlet 5	566.8
6	Outlet 6	765.6
7	Outlet 7	217.7
8	Outlet 8	1076.2
9	Outlet 9	1749.8
10	Outlet 10	1058.1
11	Branch 1a	9072.8
12	Branch 1b	9936
13	Branch 2	8519
14	Branch 3	1554
15	Branch 4	4000.7
16	Branch 5	17417.4
17	Branch 6	8331.1
18	Branch 7	3598.2
19	Branch 8	4446.0
Total		80990

Source: WUA Records, PIS

The income and expenditure of the WUA are always presented and discussed in the general assembly (GA) and passed by the GA meeting once a year. There is also annual auditing by an external auditor whose report is made open in the GA meeting. The users farmers are happy over the transparency maintained by the WUA and this is one of the important strength of farmers's institution in PIS.

F-3. Conflict Management

From the PRA and household survey result, it is found that the conflict occurrence has decreased after the transfer of management. The main reason of reduced conflicts is reported to be the better water distribution system and the development of ownership feeling among the water users. There are however reports of water stealing incidents specifically during spring and winter seasons, but those were sporadic and minor incidents some of which were solved at farmers' level while some of them needed intervention by the WUA chairman or secretary. The farm survey of the study revealed that nearly 80% percent of the farmers feel that the conflicts have reduced significantly after the IMTP. Similarly 73% of the farmers give credit to WUA and farmer's representative for their better role in reduction of conflicts within the system.

F-4. Farmers Participation for O&M

With the complete turnover of irrigation management, the WUA is financially autonomous. The WUA collects and retains all irrigation related fees from their share holders and decides how these funds are allocated. The WUA has a diversified fee structure for irrigation services, maintenance, memberships, share, visitors and complaints.

As mentioned earlier also, the water users are required to deposit of Rs 300 per ha (Rs 200 per bigha or 10 per katha) for maintenance of main canal in advance. The rule for labor contribution is as follows: like; one labor for 1 to 10 katha landowned, 2 labor for 10 to 20 katha and five labor for land owned more than 2 bigha. The farmers are paid Rs 100 for one day's work by the WUA, as the farmers are entitled to receive back their money at the rate of Rs 100 for one day's contribution of labor. This system has made the users' participation quite effective. Also it has created opportunity for poor and marginal farmers to earn by working in their own canal system. As of now usually there seem to be one hundred percent participation.

For maintaining the branches, the branch committee arrange themselves all the labor needed. Usually six persons per ha (four persons per bigha) is mandated for such repair works. In case, the repair works is not possible by the resources of the branch committee, then financial help is requested from the main committee. All most all (97%) of the respondent stated that beneficiaries are readily contributing for maintenance.

It is stated earlier also that the farmers in different branches have done some 1200 man-days worth of desilting works.

To answer the question whether the Panchakanya is financially self sustaining to carry out future O&M activities, we got to look into the average annual O&M expenditure of PIS. Assuming a command area of 450 ha and taking normal O&M expenses to be NRs. 400 per ha, the total cost comes out to be NRs. 180,000 per year. The present collection rate is already higher than required. The WUA has expressed its willingness and shown the capability as well

to collect more but their main concern is the reliability of the supply at the source. If the supply at the source goes on reduced due to external factors as discussed earlier, the institutional strength of the WUA will be adversely affected and so will be the sustainability of PIS.

F-5. Capability Development of WUA Members

It is found that the WUA members have developed their capabilities at both institutional as well as technical levels. The WUA staff and the water users in this system have learnt the needful skill and knowledge through various training programs, discussions, visits which are needed for sustainable operation and maintenance, resource mobilization, for the irrigation system management. The list of training conducted is given in Annex ???. Among the beneficiaries only 23 % of the beneficiaries stated that they have received some kind of trainings during the implementation of IMTP. Regarding the need of further training, more than 75% of the respondent stated that they need trainings. They stated that they need trainings on improved agricultural practices and use of inputs for increased production. During the focus group discussion, the groups demanded that more training be given to users rather than focusing trainings for the WUA members.

The WUA office maintains the regular accounts and records of all transactions and activities as indicated above. These records are audited annually by a government –licensed auditor. The financial records are submitted to the annual meeting of the general assembly as part of the WUA's business plan. The records are discussed in the assembly and have so far always been approved by the assembly. Regarding the activeness of representatives in management of irrigation system, 87% of the respondent stated that the WUA personnel are actively and satisfactorily engaged in their respective jobs. Majority of the respondents stated that they have confidence in the handling of financial and managerial works by the WUA leadership. This is a strong factor of the institution in the PIS.

G. Problems Identified

- Absence of land registration certificates is posing some acute legal problem in relation to acquiring about 166 ha of land that should have been otherwise the property of the WUA.
- Reduction of water at the source itself is a matter of great worry for the farmers. The available water source is also murky.
- Much leakage is occurring even to-day due to earthen and raised canal conveyance networks. WUA aspires to undertake much lengths of the canal system to make lined (pukka) that would need much more money and the WUA does not have that.
- Presence of many gates in the system requires many maintenance budgets requiring cash.
- Lack of extension activity to promote improved agricultural cultivation in the command area.
- Problem of a secured and adequate financial source for WUA to attend needed operational and maintenance activities as aspired by the WUA and common farmers.

4.2 Khageri Irrigation System

A. Water Availability Situation

Khageri Irrigation System (KIS) was basically conceived and developed as a supplementary irrigation system only for the monsoon paddy crop. The lack of alternative option for irrigation and heavy dependence on rain water for paddy cultivation prompted to undertake the implementation of KIS. The need of irrigation became further intense as the rapidly growing population (with influx of immigrants from other parts of the country) continued to diversify the cultivation of new crops with increased cropping intensity. It has been reported that the water supply at the source has been gradually decreasing due to deforestation and settlement at the catchment area of the source, Khageri River. At present the available water is even less than sufficient to meet the irrigation requirement of the total command area. In dry season the water supply gets so low that it is not sufficient to irrigate even for one fifth of the total command area. At present only the irrigators from branch no one receive irrigation water for both the seasons where as irrigators from other branches get irrigation water only for monsoon paddy.

DOI had encouraged for the discharge measurement at different places along the canal system prior to IMTP and discharge measurement system and mechanisms were developed during the implementation of IMTP. The discharge measurement is done at the headwork and Devnagar escape site (*actually the field level staffs record only the gauge measurement and as such discharge interpretations is not done*). There is not much detail information and documents available for WUA to help them undertake the water availability and water discharge measurements activities in this system. Table no. 4.13 presents the available discharge record for the year 1998. It has been learnt that the water measurement isn't done regularly and also not much use of the available information is made in operation of the system. Based on the other source information as to the availability of water, this record does not indicate the similar findings. For example, it is known that the discharge during the winter and spring seasons are very much less, however the following record does not show this.

Table no. 4.13 Discharge record of KIS

Khageri Irrigation System		
Discharge in liter/sec		
S.N.	**Canal operating month**	**Year 1998**
1	Jan	2380
2	Feb	2075
3	Mar	1650
4	Apr	1610
5	May	2100
6	Jun	3960
7	Jul	4160
8	Aug	5840
9	Sep	5910
10	Oct	5710
11	Nov	4900
12	Dec	3318

Source: Semi Annual Report No 8, IMD, DOI

It is understood that since the operation and maintenance of the main canal still lies in the hands of the agency, much of the discharge measurement activities lie in the hands of agency staff. There are no records of water flow in different branches at different times of the seasons.

During the implementation of IMTP, the DOI and the WUA were in a thought of increasing the water availability in the system by augmenting additional water from other sources like Chitrasari River in East Chitawan. The endeavor couldn't materialize because of the conflict between the people of east and west Chitawan and also due to the concern of Chitawan National Chitawan Park.

During the discussion with the farmers as well with the WUA, the farmers and their representative stated that economic and agricultural sustainability of KIS would be in question if no efforts are done to add extra irrigation water in the system. They further stated that the subsistence agriculture in the command area of KIS can not support the livelihood of the people in the command area which in turn may lead to failure of the institutional and physical strength of the irrigation system.

Despite this condition, farmers state that the water availability has been better due to IMTP intervention compared to the situation prior to IMTP. The rehabilitation works, like construction of the lined sections in the branch canals and the maintenance and desilting of the main canal, those implemented during the IMTP intervention have increased the conveyance efficiency of the canal system and helped reducing the losses. More than 70 % of the respondent stated that the water availability has increased in monsoon season. For the obvious reason, the users of branch number 1 of KIS have expressed that the water availability and reliability of supply has improved quite significantly. More than 60% of the command area of branch no 1 cultivate two paddy crops a year. Similarly 67% of the respondents in the whole system have stated that the reliability of water supply has improved compared to the scenario prior to IMTP.

One of the important improvements in terms of water availability can be realized by the fact that farmers at the tail end of the branch canal of the tail end of the system have reported that they are receiving water for paddy plantation now where as they had to rely on rain fall for irrigation prior to IMTP. Additional area is brought under paddy cultivation due to increased availability and reliability of water supply (mainly for the monsoon season) in the system.

B. Irrigation water distribution system

It is found that the establishment of O & M plan which was developed by the IMD staff along with the IMTP consultants for the WUA has helped the WUA in scheduling the available water. The establishment of Canal Management Workforce, wherein the personnel are identified, who would perform the task of O & M in their branch or sub-branch, has also helped the WUA and farmers in managing the O & M aspects.

Based on the information gathered from PRAs and households survey information, there has been some improvement in water schedule development and implementation. The field study reveals that along the branch such as Branch 4, the tail reach farmers have less complain about

the availability of water. More importantly the method of equitable distribution of water adopted after IMTP have increased their faith over the system.

The water distribution among the different branches along the main canals is done on rotation basis in monsoon season. The entire main canal length is divided onto three blocks for weekly water allocation in rotation during the monsoon paddy cultivation time.

In spring season, the water is distributed for spring paddy at Branch 1 area only.

In the branch and sub branch systems, the corresponding branch committees/tolis/upa tolis develop the water distribution on their own. The schedule and time allotment is changed as and when necessary. Among the respondents of the farm survey, 79% of the farmers have stated that the water distribution and allocation has been better after the IMTP intervention. Though there are still some problems and issues relating to the water distribution and allocation likewise the poorly maintained outlets and division structures along the branch canals and tertiary canals, the approach adopted for allocation and distribution has been highly appreciated by the farmers.

The availability and reliability of irrigation water at head and middle reach of the system is not significantly different where as those at the tail end are much less compared to the head and middle region. To encounter the problem the WUA has started the water rotation system to be adapted such that tail reach and the head reach get water at first turn alternatively. Mainly the problem has been encountered during plantation of paddy. The head reach farmers get their turn during middle of Ashad (end of June) where as the tail-enders get their turn during mid or sometimes in end of Shrawan (end of July). This has sometimes caused serious conflicts among the head reach farmers and the tail-end farmers.

C. Actual Irrigated area in dry and wet seasons.

Despite the reported total irrigable command area of KIS is 3900 ha the potential command area has been noted to be 3500ha and the actual irrigated area in the year 1995 was 2100 ha. After the IMTP intervention the irrigated area was reported to increase up to 3100 ha at the time of management transfer in 1999. IMTP has been quite successful in increasing the irrigated area (mainly in monsoon season) in KIS. The discussion with the farmer groups and WUA members in KIS revealed that at least 10% of the command area has been brought in to irrigation which didn't receive irrigation prior to IMTP in each of the branches. Actual irrigated areas in dry and wet seasons in KIS after 1999 till date are shown in Table no.4.14.

Table 4.14 Irrigated Area in Wet and Dry Seasons in PIS

Irrigated Area (ha) in Wet and Dry Seasons					
	Season	1999	2000	2001	2002
Khageri	Wet	3100	3100	3100	3100
(Branch 1&2)	Dry	246	220	230	220

Source: WUA Record and Field Survey 2003

The table shows that the area irrigated for wet period is 3100 ha for last four years. The PRA and the household survey show that there is an increase in irrigated area after the turnover. It is understandable that the record keeping on irrigated area prior to IMTP was very crude based on verbal estimation and reporting. Now that the WUAs have started recording the actual and areas

getting irrigation, which is of course, more reliable and authentic, as these would be the basis for ISF collection anyway by WUA.

Table 4.15 shows the crop coverage of different crops in KIS over the years. The crop coverage reported prior to 1997 seems quite unreliable because the maximum cultivable command area of KIS is around 3500 ha. It seems that the IMTP intervention hasn't made any marked difference in terms of increasing the cropping intensity. In reality it has brought some additional area under monsoon paddy cultivation where maize and lentils were mainly grown prior to IMTP.

Table no. 4.15 Crop Coverage of Different Crops in KIS

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Paddy	3368	Na	3600	3500	3900	3100	3100	3100	3100	3100	3100
Early paddy*	192	Na	400	372	685	600	475	450	450	400	375
Wheat	905	Na	905	1097	1300	1600	1250	1400	1500	1500	1500
Oilseeds	180	Na	300	179	197	300	Na	300	250	280	300
Pulses	250	Na	480	860	860	600	700	500	650	600	550
Maize	2065	Na	2200	2004	2004	2000	2000	1800	2100	2000	2000

Source: IMTP semi annual benefit and Impact Evaluation Report no 6 and Field Survey 2003

* The coverage under early paddy includes the crop cultivated in the low lying land (Ghol) within the command area of KIS

D. Physical System Condition and its Maintenance

During implementation of IMTP, much of the rehabilitation works carried out in KIS were lining works at different sections of branch canals. In addition to those some repair and maintenance works were carried out in the main canal. Major work done in the main canal was desilting of the main canal. These works have significantly improved the conveyance capacity of the canals as well as reduced the leakage and seepage along the canals. During the discussions with the farmers groups and the WUA representatives, farmers said that all the repair and maintenance works that were listed at the beginning were not completed till the end of IMTP. They said that they were told by DOI that those activities could not be carried out at that stage because of budgetary constraints and will be looked after later on. One of the important tasks that needed to be done was the proper maintenance of the outlets that divert water from the branch canals to tertiary canals. Farmers stated that more water is lost as wastage from those defunct outlets than the water saved by the lining along the branch canals. Farmers and WUA still hope that DOI will support them to complete the rehabilitation of the unfinished works. They further stated that the management transfer was accepted when the concerned agency (DOI) said they will come back and award second package to complete remaining works and offer new packages. While having discussion with DIO personnel and also with then subproject manager Mr. Puspa Raj Khanal, it was learnt that no such commitment was made to the users while transferring the management to the users. Farmers stated that system was not up to the par physically at the time of management transfer and the volume of the completed rehabilitation was less than their expectation. The details of the physical works carried out during implementation of IMTP and cost details are given in Annex 4.2(b)

Despite these, the household survey and the group discussions indicated the maintenance canals have improved after the turnover. Farmers point out that the repair and maintenance works done for the handover preparation have resulted in mitigating the leakage of water. Farmers have also expressed their satisfaction over the quality of the construction. The respondents informed that the maintenance activities are swift now. The regular maintenance activities are some two to three times a year. The general feeling that now the farmers and the committees have to do this job. It is found that the branch committees raise certain amount from its water users for maintenance expenses also. However, there is a lack of uniformity or a certain basis of charging for that matter.

The response of the farmers regarding the improvement in the canal condition after IMTP is given in Table 4.16. Though the farmers have expressed satisfaction over the improvement they don't seem to be much impressed over the improvement.

Table 4.16 Improvement in Canal Maintenance Condition after IMTP

Canal maintenance				
Particulars	Very Good	Good	Ok	Bad
Nos. of respondents	6	90	96	16
Percent	3	43	46	8

Source: Field Survey, IOE, May 2003

Similarly Table 4.16 reflects the farmers' response regarding the process and quality of canal maintenance and supervision. Table 4.17 shows that majority of the farmers are satisfied with the quality of maintenance and supervision activities. During farmers' group discussion some of the farmers expressed that some of the maintenance works like gravelling in the branch canals were not up to the satisfaction. They expressed that though they were involved in quality monitoring of the improvement works they were not consulted by the DIO office prior to final payment of the works to contractors. Farmers from some of the branches (4 and 6) were seriously concerned about the quality of works. The works done in those branches were observed to be better compared to work at other branches of KIS.

Table 4.17 Improved Qualities of Canal Maintenance and Supervision after IMTP

Particulars	Good	Ok	Bad
Nos. of respondents	39	150	17
Percent	19	73	8

Source: Field Survey, IOE, May 2003

After the branch canals were handed over to the farmers, the branch canals are cleaned at least once a year. The canal is cleaned at least twice in branch-1 prior to irrigation seasons of monsoon paddy and early paddy. The canal maintenance mainly involves the cleaning of bed and sides of the canal and embankment strengthening. Tertiary canals and field channels are maintained by the farmers from respective canals by providing labor or by contributing cash. Branch canals are maintained by the resources collected as irrigation service fees.

It is reported that the farmers of KIS have contributed in cleaning the main canal except the idle length. The allocation of the cleaning responsibility to the branch canals was made based on the number of members representing from the respective branch canals in the general assembly of WUA. One general assembly member representation was equivalent to 153 m. length of main canal. The idle length of the main canal from Tikauli H/W to Dev Nagar (edge of Forest) is maintained by government agency.

E. Agricultural Status

E-1 Crops and Varieties

Farmers from Chitawan Valley especially those from KIS have been observed to be quite advance in terms of adapting improved agricultural technology and inputs. Though there was no specific agricultural package associated with IMTP intervention, farmers have tried improved varieties of seeds and agricultural practices.

Crop like paddy, wheat, maize, lentil and mustard are commonly grown in KIS area. About 85 percent of paddy area is covered by Mansuli variety and the rest is occupied by other varieties like Jhapali, Sabitri, Amjhupe. Sabitri variety is getting popular among the improved varieties after Mansuli in the command area of KIS. In wheat, NL 251 and NL 297 are grown by the majority of the farmers. Rampur Yellow in maize and CH- 45 in early rice are the common varieties adapted by the farmers in crop sequence for spring season. Details of the varieties grown KIS is presented below in Table 4.18.

Table no. 4.18 Crop Varieties Grown in KIS command area

S.N	Crops	Varieties
1	Paddy	Mansuli, Ampjhupe, Jhapali, Sabitri, Chaurasi
2	Wheat	NL 297, RR 21, NL 251
3	Lentil	Sisir, Simrik, Local
4	Early paddy	Ch- 45
5	Maize	Rampur Yellow

Source: Field Survey, IOE, May 2003

E-2 Cropping Pattern and Cropping Intensity

Paddy – wheat- maize, paddy-lentil, paddy-mustard are the dominant patterns followed in KIS. Some farmers have included early rice in the crop sequence; however the area coverage under such pattern is limited. Detail on cropping pattern is presented below.

Paddy – wheat – maize
paddy-pea – maize
paddy- lentil
paddy-mustard
paddy-wheat
paddy-fallow--earlypaddy
paddy-fallow-maize
paddy-lentil-maize
paddy-mustard-maize
paddy-wheat-maize

In Some areas, peas are also included in the crop rotation. KIS has more or less similar cropping patterns to that of PIS, except that spring maize crop is grown relatively in larger area due to limited water in KIS in spring season

The cropping intensities for head, middle and tail reaches are calculated out to be 204%, 198%, and 236% respectively. The overall cropping intensity in KIS is calculated to be 213 percent. The cropping intensity prior to IMTP was reported to be 204 % (Pradhan, Naresh et al. 1995). There is slight increase of 9% in cropping intensity after IMTP. This change may not be directly attributed to IMTP intervention. There have been changes reported over the cropped area of different crops specifically the dry foot crops depending on the cost and benefit of production of those crops. It is apparent that the farmers at the tail reach are engaged more in farming during non-monsoon seasons as compared to the same in the upper reaches. It is noteworthy here to remember that the cultivation of maize is quite prevalent here. Although less water is available at the tail portion, the farmers grow non-rice crops thus contributing to higher crop intensity.

E-3 Crop Yields

Due to timely availability of irrigation in the head and middle reaches of KIS, the yields of paddy and wheat are considered normal. However, area under paddy is relatively less and yields, too are not impressive due to one moth delay in water supply in tail portion. The average crop yields recorded during filed survey are presented below in Table 4.19.

Table no. 4.19 Crop Yields in KIS Command Area(Unit: Mt./ha)

S.N.	Crops	Overall	Head	Middle	Tail
1	Paddy	2.88	3.1	2.94	2.81
2	Wheat	1.17	1.46	1.1	0.97
3	Maize	1.42	1.35	1.35	1.56
4	Winter Veg.	6.19	3.0	9.38	-
5	Lentil	0.55	0.42	0.62	0.57
6	Mustard	0.73	0.30	1.2	0.69
7	Potato	6.67	6.75	6.6	-
8	Early Paddy	3.42	2.79	3.12*	3.37*
9	Spring maize	1.52	1.28	1.62	1.64

Source: Field Survey, IOE 2003

** These reflect the yield of early paddy grown in low land (ghol) and do not receive water from KIS*

The yield of late paddy in 1995 was reported to be 2.5 mt/ha. The yield of early paddy has quite improved from 2.8 in 1995 to 3.42 in 2002. Despite the higher yield of early paddy, the cropped area is constrained by limiting water availability in spring season. Maize, Lentil and mustard crops showed diminishing crop productivity for the few years as reported by the respondents' farmers. The reasons given for decreased crop yield area again deterioration in seed quality and excess moisture in the soil. The physical improvement in KIS by IMTP has shown encouraging results in cropping area and yield for only the monsoon crop. Given the constraint on water resource in spring and winter season, the intervention could show positive impact on agriculture on dry seasons.

E-4 Chemical fertilizer

All the respondents of KIS, report that they have used Urea mainly on the paddy, wheat mustard, potato etc. However, a number of farmers (25%) applied DAP despite its high price. The respondents reported that it is not important that who look after management of KIS in terms of fertilizer application rather the availability and the price which decide whether or not or how much to use the chemical fertilizer to the crops. Only few of the respondents, reported to have applied potash. Farmers in the KIS found to be well acquainted with the advantage of using fertilizers. However, the respondents were found using about half of the recommended fertilizer dose. (Table no 4.20).

Table no. 4.20 Chemical fertilizer Application by crops in KIS (Unit: Kg/ha)

S.N.	Item	Type of chemical fertilizers		
		Urea	DAP	Potash
1.	Paddy	106	42	19
2.	Maize	61	15	22
3.	Wheat	63	33	0
4.	Early paddy	95	38	20

Source: Field Survey, IOE, May 2003

The seed rate used by the farmers is more or less similar to the quantity recommended for paddy, maize, wheat, by the Department of Agriculture. Rather it is more in some crops like paddy, lentil and mustard. Most farmers have used own seeds that are five to six years old , which might not have adequate vigor and potentiality for production. No remarkable differences were reported in seed rates after the handing over of managing to WUA.

E-5 Extension Activities

The farmers of KIS command area is severed by the extension technician of ASC located at Gunja-nagar and sub-centers of Shardanagar, Parbatipur and Fulbari for technical support to the farmers. The farmers of tail portion have the access to Rampur Agriculture Farm and Rampur Agriculture and Animal Science Campus. However, the farmers expressed their unawareness regarding the extension services available from these institutions. Neither the farmers have sought for any kind of technical assistance. The farmers accept that IAAS Rampur in the past used to teach about the methods of fertilizer application in cauliflower.

E-6 Agriculture marketing

Paddy, maize, lentil, pea and milk are the major farm products the farmers sold in the market. The markets are in and around the KIS command area including Shivanagar, Gitanagar , Jagatpur, Rampur and Narayanghat. There haven't been any significant changes in marketing facilities and services to the farmers over the period.

E -7 Farm Income

Similar to the PIS, based on the finding of the households survey, it is found that the majority of the households are selling agricultural products. Livestock is another component which has a fair share in household income. As in PIS most of the agricultural products are consumed by the farmers themselves and the surplus are sold in the market for other expenses.

The Table 4.21 shows the share and magnitude of income sources of both agricultural and non-agricultural activities. The table shows that, more than 70% of the income in average of a house hold comes from non agricultural sources. The share of sale of agricultural products is only 22.5 percent. One of the reasons for this distribution is that most of the agricultural products like cereal grains, pulses, oilseeds and vegetables are used by the farmer for their own consumption. Basically the agriculture in the area is subsistence agriculture. The scarcity of irrigation water during winter and spring season gives no incentive for the farmers to go for agricultural endeavors. The farmers of KIS claimed that they can easily double their agricultural income provided they receive irrigation water in winter and spring season.

Table no 4.21 Income Sources in KIS

S. N.	Income Source	Percentage of total income
1.	Sales of Agri products	22.5
2.	Livestock products	5.7
3.	Agri Labor	0.2
	Agri income subtotal	28.4
4.	Service	36.9
5.	Daily wage earning	0.6
6.	Shop keeping	10
7.	Skilled labor	0.1
8.	Remittance	24.0
Non-agri subtotal		71.6
Grand total		100

Source: Household Survey, IOE, May 2003

E - 8 Net Benefit and Cost of Production

The presented crop budges have been calculated for commonly grown crops in the KIS area based on the information provided by some key informants. Monsoon paddy fetches a net return of Rs 11124 per hectare which is the highest among all the cereal crops grown in the area . Likewise, the Early (Chaite) paddy brings the second highest net profit i.e. Rs 9538 as shown in the Table no 4.22 below. The maize crop also bring good profit .It is to be noted that green cobs has good market in Chitawan resulting in additional cash income. The performance of wheat crop was so impressive during last winter due to excess moisture in the soil as reported by the farmers. There several cases of late plantation for the same reason. Since the early paddy is mainly grown in command area of branch number 1 and some low lying lands of the command area of KIS, economically the spring paddy has little impact over the economy of the farmers of the command area. As discussed earlier the water available at the source is too little to irrigate the whole command area of KIS, the impact of irrigation development can only be analyzed in reference to the increased in irrigated area for monsoon and increase in yield of the monsoon crops. In this perspective the IMTP intervention doesn't seem to have much impact on enhancing the economy of irrigated agriculture in KIS.

Table No. 4.22: Benefit and Costs for Different Crops in KIS Command Area

S. N.	Item	Gross Return (A)	Production Cost (B)	Net Return C = A-B	Net Return without family labor
1.	Paddy	23040	13316	11224	9704
2.	Wheat	11862	8200	3662	1502
3.	Lentil	12500	7940	4560	1360
4.	Early paddy	24520	14982	9538	6658
5.	Maize	14000	9350	4650	2550
6.	Oilseed	10454	6568	3996	2184

Source: Field Survey, IOE, May 2003

E-9. Economic evaluation of investment in KIS

The economic evaluation of investment under IMTP has been done by comparing the total net benefit of crop cultivation before and after IMTP and by computing the net benefit of investment against the amount spent on physical and institutional development in the system. Some assumptions have been made regarding the economic evaluation and are as follows.

- The base year for economic evaluation is 2000/2001 i.e. three years after the complete transfer of the system.
- The information on cropped area, cost of production and benefit of production for the different crops cultivated in KIS before IMTP have taken from secondary sources (i.e Report on Benefit Monitoring and Impact Evaluation of Joint management Program in Khageri and West Gandak Irrigation System, 1995)
- The life period of physical improvement due to rehabilitation of the system is taken to be 25 years.
- The net benefits that would accrue from in the first second and third year after the improvement are taken as 70%, 80% and 100% respectively.
- The cost of O&M in the branch canal system for the investment has been taken as zero as the cost of O&M would be borne by WUA as per the agreement of WUA with the government. The cost of O&M of main canal and head work is taken NRs 200.0 per ha and which would be borne by HMG and it is taken as annual investment cost.
- The cost of technical assistance for IMTP and other administrative costs are not taken into consideration in the economic evaluation.
- The costs and net benefits are to be evaluated against different discount rates ranging from 2% to 20%.

Table 4.23 gives the cropped area and net benefits before and after IMTP. The table shows that there is net benefit of crop cultivation after IMTP is higher by NRs . 1156676.0 comparing to that before IMTP. Given the total investment (physical improvement and institutional development) made in KIS of NRs 32,978,165, the return seems not much significant.

Table 4.23 Cropped area and Net Benefit in PIS before and after IMTP

Crop	Area cropped before IMTP (ha)	Net benefit before IMTP (Rs/ha)	Area cropped after IMTP (ha)	Net benefit after IMTP (Rs/ha)	Total net benefit per year before IMTP	Total net benefit per year after IMTP
Late Paddy	3100	14737	3500	11224	45684700	39284000
Early Paddy	160	11453	375	9538	1832480	3576750
Wheat	1000	4504	1500	3662	4504000	5493000
Summer maize	2000	3747	2000	4650	7494000	9300000
Pulses	300	6986	550	7960	2095800	4378000
Oilseed	179	2586	300	3996	462894	1198800
Total					62073874	63230550

One of the major reasons for such low return on investment is the increase in cost of production of major crops. The discussions made on the previous sections of this report regarding the crop yield and cropping intensity have already revealed that there hasn't been much change in yield of major crops. Despite the water scarcity in spring season the cropped area for early paddy and spring maize hasn't increased despite the canal system was physically improved.

The net present value of the cost of investment and that net benefit EIRR under different discount rates are computed as below. The details of computation of net present values of investment and the benefit are given in Annex 4.6 (b)

Discount Rate	NPV of Investment	NPV of Benefit
2	47971818	21858578
4	49330600	18719189
6	50725252	16321625
8	52156296	14466856
10	53624255	13014413
12	55129650	11863983
14	56673004	10943092
16	58254840	10198783
18	59875680	9591928
20	61536046	9093300

The above table shows that even for the discount rate of 2% the net present value of investment is more than double than the net present value of the benefit in the base year (2000/2001). This clearly shows that the EIRR would go negative and the return on investment is negative.

F. WUA Status

F- 1 Membership

Like in PIS, the membership of WUA is a must to all the beneficiaries for having right and to be an eligible voter and candidate of WUA executive committees. The membership of WUA is called the share membership and distributed to the farmers on the basis of household. Table no 4.23 shows the membership status branch /minor wise in the KIS.

Table 4.23 shows that not all the water users have become the members of the WUA. Though the overall membership is more than 62 % and it is in increasing trend, the 38% of water users being non-member of the WUA raised serious concern over the involvement of all the users in the WUA activities. This has further been supported by the focus group discussions that study

team had with different farmers' groups. One of the reasons for such reluctance of the farmers in joining the WUA is their lack of confidence over the WUA. Farmers reported that they were not consulted and they hadn't given their consent for the take over before taking the management responsibility of branch canals.

Table no. 4.23 Membership Status in the KIS

S. N.	Canal name	Population of farm household	General membership	% Accomplishment
1.	BC1	564	520	92.2
2.	BC2	836	477	57.1
3.	BC3	454	314	69.2
4.	BC4	504	222	44.0
5.	BC5	499	249	49.9
6.	BC6 east	672	526	78.3
7.	BC6 west	652	355	54.4
8.	BC7	343	317	92.4
9.	BC8	462	252	54.5
10.	Minor 1	158	122	77.2
11.	Minor 2	298	94	31.5
12.	Minor 3	172	111	64.5
13.	Minor 4	112	72	64.3
Total		**5726**	**3556**	**62.1**

Source: WUA Records, 2003

Another factor is that not all the reported command area under KIS gets reliable supply of irrigation water even for summer season. Farmers feel that unless extra water from any other sources is added in to the system, they cannot have better agricultural production. In the present condition of water availability, they don't see any point on taking the management responsibility and responsibility of O&M of branch canals. They feel that WUA alone can not sort out the major problem that is the limiting availability of water in the system. Hence there is less incentive among the farmers from the tail ends of the irrigation system to join into the institutional set up of KIS.

F- 2 Resources collection – ISF, share distribution, other financial resources

In Khageri, the O&M cost of the main canal is the responsibility of the government. There is an understanding that the WUA will bear 15% of the cost. Besides these decisions regarding canal operation, including the main canal, are carried out by the WUA. The responsibility of fee collection lies with the branch committees and the main committee (MC) is entitled to collect 20% of the collection from the branch canals. The WUA is also required to pay 25% of its collection according to Irrigation Policy, 2053. But in KIS this hasn't been done so far and government hasn't asked about it.

The collection of ISF in Khageri is only for one crop, monsoon rice except for Branch-1 and part of Branch-2 where early paddy is cultivated. The spring and winter crops are cultivated under rain fed condition. The ISF rate is NRs 60 per ha per crop. Besides ISF, each branch canal carries out canal cleaning and desilting work employing voluntary labor. The average rate is 3 labor per ha of land. The type of resources for O&M and details about their collection is given in following sections.

A. Membership fee

It is learnt that Rs 56440 has been collected so far as membership fee by June 2003. As of now some of the branches (Branch-1, Branch-6(east) and Branch-7) have shown their effectiveness in terms of the membership fee collection where as some of the branches (Branch-2, Branch-4 and Branch-5) are lagging behind. One interesting thing has been observed that the membership fee as well as the ISF collection is low in the branches which are quite long and where farmers from the tail end haven't got adequate and reliable water. Despite some difficulties in terms of WUA functioning, it has been quite evident that the WUA of KIS is in process of evolution and is working toward making the institution sustainable. The study team had got opportunities to attend the general assembly of some of the branches (Branch-1, Branch-4, Branch-5 and Branch-7). One thing was clearly observed there that farmers have a clear understanding that the responsibilities of operation and maintenance of the branch canals lies up on the respective branch committees and the users. They are trying to work out ways to generate resources so that they would be able to meet the regular O&M expenses. Also they have developed the water allocation and distribution plan based on the experience of past operational activities of the canal system.

B. Share Certificate Distribution Fee

For acquiring the share certificate, the water users are required to pay at the rate of Rs 30.0 per ha (or Rs 1.0 per Katha). It is learnt that the general assembly is considering the new rate of share certificate distribution fee. As of now, there is not much effort going on to collect the share distribution fee. The collection is in the range of 34 percentages. The status of share certification collection is presented in Table no. 4.24 as follows:

Table no. 4.24 Membership status in the KIS

S. N.	Canal name	Design Area	Currently irrigated area	Share certification Collection Target @ Rs 30/ha	Actual Collection	Fee collection Efficiency (%)
1.	BC1	266	235	7050	6972	98.9
2.	BC2	575	450	13500	1218	9.0
3.	BC3	392	270	8100	1112	13.7
4.	BC4	274	127	3810	810	21.2
5.	BC5	265	265	7950	1020	12.8
6.	BC6 east	446	338	10140	3145	31.0
7.	BC6 west	424	333	9990	3952	39.5
8.	BC7	238	238	7140	3879	54.3
9.	BC8	310	177	5310	2572	48.4
10.	Minor 1	189	106	3180	1274	40.0
11.	Minor 2	256	201	6030	1635	27.1
12.	Minor 3	100	66	1980	345	17.4
13.	Minor 4	60	40	1200	979	81.6
Total		**3900**	**2846**	**85380**	**28913**	33.9

Source: Survey, IOE, May 2003

C. ISF collection

The ISF rate is Rs 60 per ha per crop which would mean that about Rs 170760 of annual ISF is targeted for actual irrigated areas of say,2860 ha of land. But looking at the collection being done for the last four years, the accomplishment is just around 33 to 40 percent of the targeted amount. The ISF is being collected at the branch or sub-branch level. They retain some amount needed for the maintenance and rest is being sent to the main committee. The main committee is using the collected fund for various other development activities such as purchases of seeds, fertilizers to be distributed among the farmers of the command area. The ISF collection over the years is given in Table no 4.25. It can be seen from the Table that there hasn't been any increase in ISF as well as in its collection.

Table 4.25 ISF Collection in KIS

Year	ISF in NRs	Collection Efficiency
1993/1994	89474	53.2
1994/1995	107213	63.8
1995/1996	92638	55.1
1996/1997	105316	62.7
1997/1998	126794	75.5
1998/1999	93731	55.8
1999/2000	96355	57.2
2000/2001	87456	51.9
2001/2002	91634	54.4

D. Other financial sources

Basically there has been some disagreement between BCs and MC regarding the 20% collection of the ISF by MC. The MC share is mostly spent on administrative cost. Hence BCs argue that MC should be able to generate resources for its functioning from other sources. Some of the sources can be generated by the trees and also from the land handed over to the WUA by the government. No actions have been taken regarding collection of resources from other sources. WUA has collected some money from the award of contract for fishing in the head works and in some portion of idle length of main canal.

F-3 Conflict Management

The PRA and household survey results and findings indicate that the conflict occurrence has decreased somewhat after the transfer of management. The main reason being comparatively improved water distribution system and the fact that now the farmers and WUA for that matter has to solve their problem by themselves. It is apparent that the recently held interaction meetings by the WUA executives with the branch executives and general farmers have had a very positive impact on the ownership feeling of the Khageri Irrigation System. The improvement in conflict reduction after the IMTP intervention is shown in Table 4.26. The household survey results shows that 79% percent of the farmers responded that the conflicts regarding water distribution has significantly reduced after IMTP. Among them 30% of the respondent feel that conflicts have been reduced to nil. On the other hand nearly 39 % of the

farmers feel that there are still occurrences of conflicts among the water users but they are never serious and are sorted out in negotiation or through involvement of WUA. Rest opined that there hasn't been any change regarding the reduction of the conflicts. Still some conflicts among the farmers are reported to take place specifically among the farmers from the tail reaches of the system.

Table no 4.26 Reduction in Water Distribution Conflicts in KIS after IMTP

Particular	Reduced Conflict	Not Reduced	No conflict at all	Some conflicts
No of respondents	166	41	63	81
Percent	79	19.52	30	39

Source: Field Survey, IOE, May 2003

F-4 Farmers Participation for O&M

With the agreement of WUA and government that branch canals be turned over for irrigation management and main canal be jointly managed in 2055/2056, the government and the WUA are jointly managing KIS. The WUA collects and retains all irrigation related fees from their share holders and decides how these funds are allocated. The WUA has a diversified fee structure for irrigation services, maintenance, memberships, share, visitors and complaints. For maintaining the branches, the branch committee arrange themselves all the labor needed.

To answer the question whether the KIS is financially self sustaining to carry out future O&M activities, we got to look into the average annual O&M expenditure of KIS. Assuming a command area of 3500 ha and taking normal O&M expenses of the branch canals only (as main canals being maintained by the government) to be NRs. 100 per ha, the total cost comes out to be NRs. 3,50,000 per year. The present collection rate is not sufficient to meet the O&M expenses required. Though due to topography and physical characteristics the normal O&M expenses of KIS is low, but the given rate of collection will not be sufficient meet its O&M expenses. It was learned that in the fiscal year 1997/98 the GA of KIS proposed to double ISF from Rs. 60 to Rs 120 per ha. There was strong opposition from the farmers toward this proposal and GA finally abandoned the idea of increasing the ISF.

F-5 Capability Development of WUA members

It is evident that capability and understanding of WUA executives have been increased over the period with the increased exposure to various training programs, discussions, meetings and visit programs. Their capabilities in institutional development, operation and maintenance of irrigation system, account keeping, and several other issues are apparent. The activities of repair works at sites, water distribution scheduling and the collection of ISF and share certificate fee are the testimony to this development. It is noteworthy that the WUA executive arranged one-day interaction program on 2058/3/19 with other branch executives as well as the executives from the different VDCs so as to discuss on the expected roles and responsibilities each side. The general assembly held on 2055/9/24 had ratified a resolution wherein it is mentioned that the main canal also should be taken over from the department of irrigation. Their concern for sustainable development of O & M matters as well as sustainable sources is factor that indicates

to the institutional development of the water user organization. The list of capacity development activities organized for institutional strengthening of WUA of KIS is given in Annex-4.5.

In conclusion, the institution of KIS has grown up to some extent but hasn't really developed to take care and manage the institutional affairs efficiently. It was observed that farmers are fully aware with the fact that the management responsibility of the branch canal system lies fully upon them and they have to be part of the management of branch canals systems. Some of the branches were found quite active in operation and maintenance and ISF collection where as some branches were found quite inactive. There seemed a communication gap between the Main committee and branch committee regarding the sharing of responsibility and the resources as well. Because of the fact that the intervention couldn't bring significantly improvements and changes in agriculture and economy of agriculture in the command area, its quite hard for farmers to contribute in building up the institution. Despite all this there is enthusiasm and commitment among most of the farmers.

F. Problems Identified

Some of the major problems and the issues related with the physical , agricultural and institional aspects of irrigation management of KIS has been briefly given below.

- One of the major problems of KIS is the limiting water availability at the source. The system cannot supply adequate water even in the monsoon season if there is low rainfall or late monsoon.
- The branch canals of the system were handed over to the users without wide consultation and approval of the general assembly of KIS. Hence farmers have resentment over the process of handover. They also feel that the physical system wasn't adequately improved and not up to the par at the time when it was handed over. They still feel that there are lots of short comings in the system and farmers alone cannot sort out the problems because of the lack of resources.
- The WUA is having difficulty in collecting the ISF from the farmers. WUA executives' voice that there should be some legal authority bestowed upon the organization so that they can administer the resource mobilization as well as the reinforcement of promulgated rules and regulations by the WUA.
- Low discharge in the canal during low rainfall and during non-monsoon season. Hence the irrigation reliability is low. The water available is only for monsoon season for most part of the command area.
- Difficulty/lack of communication between the main committee and their water users groups and then with the common farmers.
- Still the system is not physically complete as the outlets and control and regulating structures along the branch canals are not properly maintained leading to wastage of irrigation water.

- Increasing urbanization in part of the command area and subsistence agriculture has caused decreased enthusiasm among the water users of the command area.
- There wasn't any agricultural development programs associated with the IMTP intervention. Due to this the increased system performance what so ever was achieved by IMTP intervention couldn't be utilized for enhanced agricultural production. This has definitely affected the institutional strength and governance of WUA over the system.

4.3 Findings Nepal West Gandak Canal Irrigation System

A. Water Availability Situation

The system draws its share of water of 300 cusecs from the intake point of West Gandak, a gated opening. In principle, West Gandak doesn't face any water at the source and system can have full discharge year round if the infrastructures downstream are in proper condition. However due to operational constraints resulting from occasional floods and silt laden water, water availability during the monsoon season is always variable. The control of the barrage is with the Indian authorities and the farmers also feel that they are not sincere in maintaining the required pond level at the barrage location. The Command Area Development Project (CADP) had aimed to increase the system efficiency by means of radical improvements by implementing rehabilitation of canals, associated structures and drains. The impact of CADP wasn't long lasting and the problems in the system got more complex regarding the operation of the system. With the improvement of structures, catch up maintenance and opening of additional gate in headwork the discharge in main canal has been increased.

Record of discharge is maintained by WUA in two places on the basis of gauge reading. However the water availability in main canal is dependent on the level o water in the Narayani River. The control of a barrage gate operation is under the control of Indian government. It was found that, as agreed between the two governments of India and Nepal, the level of water in the river has to be maintained up to 365-meter mark, but the Indian government has not followed it. During rainy season (July August), due to the fear of heavy flood at night, they raise the barrage gate, so the level of water automatically goes down. Consequently, the flow in main canal of NWGIS is decreased.

During summer season, farmers complain about scarcity of water in the tail end side. It is known that in head and middle reaches, water from the canal adequately available. Due to unreliable supply of water, farmers have bores from which they augment irrigation water even in monsoon season for transplantation of paddy. Water is adequately available during winter season, throughout the command area but the supply of irrigation water in spring is not adequate as well as reliable. One of the main reasons for this is that main canal of NWGIS remains closed for maintenance (desiltation) activities. Spring crops are not so extensively grown in the command area except sugarcane. Farmers of the command area stated that they need irrigation water for sugarcane in the months of April and May but can't receive irrigation because canal remains closed during the period. However, some farmers, who grow vegetables, have installed the

shallow tube wells considering the unreliable management of water. The WUA is trying to distribute water for spring season too in coming seasons.

After the system was completely handed over to the farmers the measurement and record keeping of the discharge at the main canal became quite irregular. The study team could have access to the discharge records till the year 1998 and that is given in Table 4.27 below.

Table no. 4.27 Discharge Record in NGWCIS

Discharge in Lit/sec							
Canal operating month	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**
Jan	Co	Co	Co	Co	6583	Co	
Feb	Co	Co	Co	Co	6771	Co	
Mar	Co	Co	Co	Co	6328	Co	
Apr	Co	3453	Co	Co	7297	Co	
May	6733	4017	Co	Co	6845	3202	
Jun	7563	4376	Co	3750	8500	4315	
Jul	Co	3668	6027	2970	4078	Co	
Aug	Co	3754	6114	2450	6669	4259	
Sept	Co	3035	Co	Co	7023	4371	
Oct	3598	3475	CO	Co	Co	Co	
Nov	5829	3378	Co	Co	Co	4284	
Dec	Co	2985	3150	6950	Co	4474	

(co = canal closed)

Sources: IMD Semi-Annual Report no 8

After the implementation of IMTP activities in NWGIS, a number of physical improvement activities were carried out to enhance the performance of the system. Mainly desiltation works at the main and branch canals were done to increase the conveyance capacity of the canals. Also structural improvement works like cross drainage structures improvement were done. The farmers of NWGIS stated that the water availability and reliability was significantly improved just after the system was rehabilitated.

They further added that the system got deteriorated after the system was handed over to the users as the WUA management couldn't carry out the needed maintenance works. Also the some branches and part of the system was damaged during the flood in monsoon 1998. The WUA expected some help from government for repair but government couldn't provide adequate fund in time. The system got deteriorated over time.

It was reported that after the system was completely handed over to the users in November 1997, the WUA couldn't collect the ISF as farmers felt that they can afford not to pay the ISF as the government has nothing to do with the management of the system. WUA couldn't enforce rules upon the farmers. There were incidences of malpractices and misuse of ISF done by WUA members and cases were registered against them in the office of Chief District Officer. Political polarization and groupism among the WUA made the WUA somewhat defunct. As result, the irrigation system wasn't properly maintained and operated.

During the study the farmers and even some of then executives reported that there wasn't any wide consultation among farmers regarding the taking over of the system completely. Despite the above facts, 51% and 48% of the farmer respondents from NWGIS have stated that adequacy

and reliability of the water has improved after IMTP intervention compared to the situation prior to IMTP in monsoon as well as winter season respectively. The head and middle reach farmers are relatively happy over the availability and reliability of water supply compared to the tail end farmers.

B. Irrigation water distribution system

The West Gandak Irrigation System was designed as a highly flexible system in terms of water distribution and consisted of check structures at every turnout. The gates used in the division structures were manually adjustable gates. It was assumed that with introduction of flexible supply-oriented water delivery, farmers could receive the desired amount of water in accordance with their need at any moment. But this requires 100 operators and relatively large maintenance budget. The large number of check structures also caused the silt deposition in the main canal. Canal operation plan (COP) has been developed during IMTP implementation period. Accordingly canal management work Force (CMWF) has been established in every tier of canal of the irrigation system. Training to the CMWF has also been provided on canal operation methods techniques and administration processes as well. All the members of the canal management work force except in the main canal are expected to provide volunteer service. Five members of the main canal management work force are paid nominally by WUA.

However, it was found that the prepared COP has not been implemented in the field because it was not complete in itself. The main canal is divided into four regions for managing the water distribution system. One CMWF member is appointed in each region and 4 members. These 5 CMWF are mobilized in the canal operation and distribution system. During seedling preparation and transplantation of paddy, water in canal was distributed in the tail end at first and gradually to the middle and head reaches. Water distribution system in the head reach is quite institutionalizing with in the branches. Within the branch and its field channels, rotation system has been established. The entire branch canals command area is divided in to three parts, and rotation is observed on the basis of area to be irrigated. If there is insufficient water, rotation schedule is changed with the monitoring of chairman of respective WUA committee. With in farm ditches, farmers themselves with their Upa-toli committee prepare a rotation plan and water is distributed. Most of the area of head reaches remains wet due to the seepage of both canal systems viz Nepal Gandak and Indian western canal.

Water distribution system in the middle and tail reach is not found so systematic. Rotation or any schedule is not maintained. Water within the branch is distributed freely. There is not any specific rule or regulation for distribution of water. Water users report that there is no reliability of water even in the middle reach. While in tail reach, farmers complain water being not available easily for them. There is also not any systematic management process and procedures established.

The survey results of the study show that more than 53 % of the farmers feel that the water distribution has been improved after the IMTP. The group discussions revealed that the availability and the distribution were significantly improved during the time of turnover compared to the early days of IMTP. But the physical, institutional system of NWGIS collapsed over the years after the WUA took over the responsibility of management.

C. Actual irrigated area in dry and wet seasons.

The total command area of 10,300 ha is reported for both Nepal western canal and Piparpati Parsauni irrigation system (8700ha and 1600ha respectively). Record of actual irrigated areas, so far reported, is a subject to be confirmed yet. However, the record of ISF collection could be taken as rough estimate in this aspect. However the data collected through various sources, reported in Semi Annual Progress Report (SAPR-8). and report on Benefit Monitoring and Impact Evaluation of West Gandak System as given Table 4.28 below.

Table no. 4.28 Irrigated Areas in Wet and Dry Seasons in NWGCIS

Irrigated Area (ha) in Wet and Dry Seasons						
	Season	1995	1996	1997	1998	1999
West Gandak	Wet	7623	9825	7082	7082	7082
	Dry	2200	3800	4500	4500	4500

Source:SAPR-8, SMTP, IMD, DOI,

The table shows that there is nearly 7% decrease in the irrigated area in wet season and the dry season area has increased by 100% by 1999. This can be explained by the fact that after 1995 the farmers in NWGIS have changed their cropping pattern shifting to sugarcane cultivation. This change is mainly attributed to the establishment of sugar mills in the nearby area and the crop was fetching higher returns compared to other crops.

The household survey conducted reports on the number of beneficiary farmers and their irrigated land area on each canal outlet. According to this the total irrigated land for Nepal western Gandak Canal Irrigation System is 6160 ha with 169 outlets while that for piparpati-parsauni system is 922ha. The household survey further indicates that the cropped area has reduced by 10% over the years after the system was handed over to the WUA. This is mainly due to the decreased reliability in supply of irrigation water. Major issue is that farmers don't get irrigation water when they need the most. Farmers rely on pumped water even for plantation of paddy during monsoon season.

In the head reach, respective WUA committees have maintained the records of the farmers and their irrigated area. In Chhibani water course the actual irrigated area is 112 ha. In middle and tail reaches, the records were not found. Farmers including the WUA committee members agree that the definition of irrigated area is confusing. If there is regular flow in field for the whole crop growth period and the flood did not disturb, then that area is considered to have obtained full irrigation. Two or three times irrigation for rice crop is not considered a case of complete irrigation availability in the view of farmers. For the same reason, the record in not maintained in the lower tier for last two years in tail and middle reaches of the canal system.

D. Physical system Status

The house hold survey indicated that the maintenance of canal have deteriorated after the turnover. Actually, they were referring to the main canal in general. Farmers point out that the repair and maintenance works are not done as regularly and as needed at the main canal. After the complete handover of the system, the responsibility of operation and maintenance of whole of the system lies upon the WUA. Despite this HMG/N was supporting the WUA with funds for

some years to repair the damage caused by the flood. Main problem was the maintenance of main canal as it demanded huge cost just for desiltation. But the repair maintenance works at branch and tertiary level had gained more systematic and equitable approach especially at the head reaches.

There have been many reporting of the damages caused by the flood. While, the affect of flood is quite conspicuous in main canal, so also the low lying command area at the southern side. It is estimated that roughly the ponding water resulting from the flood affects one third of the command area in NWGIS. Table 4.29 shows farmers' response over the physical condition of the canal and quality of maintenance. The table shows that majority of the farmers aren't satisfied with the condition of the canal system. It was also reported that there hasn't been proper maintenance in the canal system except the desilting works in some part of the main canal. The branch canals are damaged due to flood and significant part of the command area is prone to flood. Parsauni minor (getting irrigation water from Indian gandak canal) has some better status in this regard.

Table no 4.29 Status of Canal Maintenance in NWGCIS

Canal Maintenance				
Canal System	Very Good	Good	Same	Bad
Head	0%	15%	65%	20%
Middle	0%	5%	14%	81%
Tail	0%	13%	0%	88%

Sources : Field Survey, IOE, May, 2003

E. Agricultural Status

E-1 Crops and varieties

A number of crops are grown in West Gandak irrigation system command area. Paddy, sugarcane, wheat and maize in cereals, lentil, peas, the pulses, mustard and oilseeds are the main crops. In addition, vegetables are seen in a small area. The varieties grown in the area is presented below.

Table no. 4.30 Crop Varieties Grown in Nepal West Gandak Command Area

S.N.	Crops	Varieties
1	Paddy	Radha7, Radha 17, Chaite 4, Masuli, Sabitri, Sajiwan 49, Sajiwan 50, China, Makarkadda, Sarju 52, Saju 49.
2	Wheat	NL 297, UP 262, RR 21, NL 1036, Triveni
3	Lentil	Smrik
4	Mustard	Type 2
5	Sugarchane	BO 91, BO 110, BO 767, 92423
6	Maize	Arun – 2, Rampur Composite.

E-2 Cropping Pattern and Intensities.

The cropping pattern in the command area is decided by availability of irrigation water, soil type and demand of crops in the markets. Majority of the farmers (80%) have grown two crops a year. Paddy-wheat and paddy-lentil mustard are the common patterns followed in the area. In the areas with tube well facility, the farmers (2%) have grown three crops a year, namely paddy-

wheat-maize and paddy-wheat-vegetable. Due to the availability of market for sugarcane farmers in command area have shifted toward the sugarcane crop. Another factor for increased cropping of sugarcane is the reduced water availability and reliability for other crops in NWGIS specifically in the winter and spring seasons. The cropping intensity in NWGIS at present is reported to be 187%. It was reported that the cropping intensity in NWGIS in 1994 was 153%. (Naresh Pradhan, 1994). Hence there is 17% decrease in cropping intensity. Specifically the cropping intensity in the tail reaches of the system has been affected by the reduced water availability and reliability in the canal system. Though IMTP had envisaged diversification in cropping pattern toward high income crops, such diversification couldn't get materialized.

The details of crop sequence are presented below.

Paddy-wheat
Paddy-lentil+mustard
Paddy-lentil
Paddy-Mustard
Paddy-wheat-maize
Paddy-Vegetable(Potato/Couliflower)
Paddy-vegetables (onion, laddy's finger)
Sugarcane
Paddy-wheat-vegetables.

E-3 Crops yields

The paddy and wheat crops have shown satisfactory level of crop yields this year as compared to previous years. Though the Benefit Monitoring and Impact Evaluation Study of Joint Management Program (Pradhan, Naresh et al. 1995) reported that yield of paddy crop was as high as 3.4 mt/ha in 1994, the yield of paddy has not gone above 3.0 ton/ha in the years during and after IMTP. The productivity of other crops are found to be rather less when compared with those of previous years. In fact agricultural support service has remained weak in the command area in spite of good relation of WUA with District Agricultural Development Office (DADO). Low crop yields could probably be due to agriculture extension activities operated in low scale than required. It also could be due to weak coordination among WUA members in management of inputs (quality seed, chemical fertilizer, water management etc) in improving crop productivity. Table 4.31 shows the crop yields recorded during household survey.

Table no 4.31 Crop Yields in Nepal West Gandak Irrigation Command Area

(Unit: ton/ha.)

S. N.	Crops	Overall	Head	Middle	Tail
1.	Paddy	2.79	3.19	2.67	2.80
2.	Wheat	1.50	1.04	1.50	1.96
3.	Lentil	0.40	0.28	0.67	0.30
4.	Mustard	0.30	0.28	-	0.71
5.	Winter Veg.	3.01	-	3.01	-
6.	Spring maize	-	1.94	1.38	-
7.	Sugarcane	24	28	24	22

Sources: Field Survey, IOE, May. 2003.

Overall cropping intensity in Nepal West Gandak is estimated at187 percent. The intensities in the head, middle and tail reaches of the command area are recorded in the order of 192,175 and 180 percent. Overall intensity is relatively less due to inclusion of sugarcane in about 10 percent of total area which occupies the land all round the year.

E-4 Fertilizer application

Almost all the respondent farmers reported to have used Urea, while 80 percent applied DAP and three percent did so for potash. Mainly paddy, wheat and mustard have received chemical fertilizer. The farmers realized that chemical fertilizer was not available in time and in adequate quantity. So the farmers bought the chemical fertilizer from India. They think that the chemical fertilizer brought from India is relatively of low quality. While at the quantity of the fertilizes applied in paddy, lentil, wheat and sugarcane, it can not be considered low input ompared to the recommended dose (Table 4.32)

Table no. 4.32 Chemical Fertilizer Application in NWGIS Command Area

(Unit: kg./ha.)

S. N.	Item	Type of Chemical Fertilizer		
		Urea	DAP	Potash
1.	Paddy	117	117	38
2.	Lentil	75	50	-
3.	Wheat	150	75	-
4.	Sugarcane	158	150	22

The seed rate used by the farmers is relatively higher as compared to the quantity recommended for paddy, maize, and wheat. It is probably due to the risk associated with moisture stress and adversely weather condition. Most farmers have used own seeds.

E-5 Extension Activities

Agricultural service centers of Jamunwa, Bhujahawa, Majhauni, Kushma, Pali and Rani Nagar are responsible for providing agricultural extension services to the farmers of the command area. It is learned that the extension teaching activities such as production demonstration, minikit demonstration, and seed multiplication are conducted in the area moreover; the farmers have been trained in various subjects related to agriculture. Farmer's groups are being technically supported from District Agriculture Development Office. In overall, the relation between agriculture development office and WUA's is found good, however further efforts are required to contribute in the crop productivity. DADO has already provided certain quotas of demonstration and training as extension activities particularly for the command area. The demonstration on the operation of hand tractor (simultaneous ploughing and wheat seeding) was conducted in two hectares of land. It was found that the use of hand tractors resulted in good soil preparation thus increasing yields.

WUA members are also disseminating the message to the beneficiaries not to raise paddy nursery by all at a time due to limited water supply. The farmers of tail reaches received extension services form Bisampura ASC learned to have served the farmers of middle reach area.

E-6 Agricultural Marketing

Paddy, wheat, mustard and sugarcane are the major commodities traded by the farmers in the area. Number of hat bazaars (market exist in and around the command area in addition to Parasi, the district head quarters. The farmers reported that the traders themselves approach them in

advance for purchase of farm commodities. There hasn't been significant improvement in terms of agricultural marketing for the farmers in the command area.

E-7 Farm Income

Based on the finding of the household survey, it is found that the majority of the households are selling agricultural products. Livestock is contribution a very little in house hold income. About 60% of income of farmers in the command area of NWGCIS is derived from sale of agricultural products and more than 70% of the farmers derive their income from agricultural sector. Table no 4.32 shows that share and magnitude of income sources of both agricultural and non-agricultural activities. It is clearly observed that agriculture is the mainstay of livelihood for the people in NWGIS.

Table no 4.32 Income Sources in NWGCIS

S.N.	Income Sources	Percentage of Total Income
1.	Sales of Agri Products	60.2
2.	Livestock products	8.3
3.	Agri Labor	3.6
	Agri Income Sub-total	72.1
4.	Service	20.2
5.	Daily Wage earning	2.1
6.	Shop keeping	3.9
7.	Skilled labor	1.7
Non-agri sub-total		27.9
Grand total		100

Source : Field Survey, IOE, May 2003

E-8 Benefits and cost of production.

The crop budget analysis indicates the profitability of the crops grown. The analysis indicates a high net profit (Rs.11846per ha) in the sugarcane farming. However one has to be clear that it is the profit for whole year (i.e. two crop seasons). The average return for paddy is estimated at Rs. 7391. Lentil crop reported to have produced meager yield last year, unlike that of PIS and KIS command area. As a result it could fetch good return i.e. Rs 1100. It is to be noted that farmers are increasingly attracted to the vegetable farming, which provide highest net return, although it could not be presented here.

Table no. 4.33: Benefit and Costs for Different Crops in NWGIS (In NRs./ha)

S. N.	Item	Goss Return (A)	Production Cost (B)	Net Return (C=A-B)	Net Return (without family labor)
1.	Paddy	24500	17109	7391	5641
2.	Wheat	18216	13080	5136	3666
3.	Lentil	9000	7900	1100	(400)
4.	Sugarcane	42000	30154	11846	9746

Source : Field Survey, IOE, May 2003.

E-9. Economic evaluation of investment in NWGIS

The economic evaluation of investment under IMTP has been done by comparing the total net benefit of crop cultivation before and after IMTP and by computing the net benefit of investment against the amount spent on physical and institutional development in the system. Some assumptions have been made regarding the economic evaluation and are as follows.

- The base year for economic evaluation is 2000/2001 i.e. three years after the complete transfer of the system.
- The information on cropped area, cost of production and benefit of production for the different crops cultivated in NWGIS before IMTP have taken from secondary sources (i.e Report on Benefit Monitoring and Impact Evaluation of Joint management Program in Khageri and West Gandak Irrigation System, 1995)
- The life period of physical improvement due to rehabilitation of the system is taken to be 25 years.
- The net benefits that would accrue from in the first second and third year after the improvement are taken as 70%, 80% and 100% respectively.
- The cost of O&M in the canal system for the investment has been taken as zero as the cost of O&M would be borne by WUA as per the agreement of WUA with the government.
- The cost of technical assistance for IMTP and other administrative costs are not taken into consideration in the economic evaluation.
- The costs and net benefits are to be evaluated against different discount rates ranging from 2% to 20%.

Table 4.34 gives the cropped area and net benefits in NWGIS before and after IMTP. The table shows that there is net benefit of crop cultivation after IMTP is lower by NRs. 32406478.0 comparing to that before IMTP. The results show that the IMTP intervention couldn't enhance the agricultural and economic status of the system. Major reason for such negative return on investment is the reduced cropped area of monsoon paddy. Such decrease is attributed to the increase in the cropped area of sugarcane. Farmers had shifted to sugarcane cropping in the early days of IMTP (1995) because of the higher return they were getting in terms of yield (35.0 ton/ha) and in terms of price(about 1800). At present the yield of sugarcane is reported to be 25 ton per ha on an average and the price that sugarcane is fetching is around NRs 1400/ha. The farmers have even reported that the sugar factories in the vicinity are buying sugarcane from India at cheaper price leaving Nepalese farmers at dire strait. Another factor for the low yield of sugarcane is that the crop doesn't get irrigation during April/ May (critical period for the crop) as the NWGIS canal remains closed for maintenance. The total investment (physical improvement and institutional development) made in NWGIS of NRs 31,885,439.0 the return seems quite unproductive.

Table 4.34 Cropped area and Net Benefit in PIS before and after IMTP

Crop	Area cropped before IMTP (ha)	Net benefit before IMTP (Rs/ha)	Area cropped after IMTP (ha)	Net benefit after IMTP (Rs/ha)	Total net benefit per year before IMTP	Total net benefit per year after IMTP
Late Paddy	7623	13980	7082	7391	106569540	52343062
Wheat	1000	5598	1500	5136	5598000	7704000
Summer maize	450	5290	650	4500	2380500	2925000
Lintel	1000	3652	1300	1100	3652000	1430000
Sugarcane	1000	28522	1500	11846	28522000	49913500
Total					146722040	114315562

One of the reasons for such low return on investment is the increase in cost of production of major crops. The discussions made on the previous sections of this report regarding the crop yield and cropping intensity have already revealed that there hasn't been improvement in yield of major crops rather they are decreased. Over the years the system's physical capacity has decreased to a very low state that the system cannot provide irrigation water to users adequately and reliably. As a result the agricultural status of the system is in very bad state comparing the efforts and resources put on the system for its improvement.

As the net benefit on agriculture has been found negative, the EIRR hasn't been computed The details of computation of net present values of investment and the benefit are given in Annex 4.6 (c)

F. WUA Status

F-1 Membership

Membership of WUA is a must to all the beneficiaries for having water right and to be an eligible voter and candidate of WUA executives committees. The membership of WUA is called the share membership and distributed to the farmers on the basis of household. However the membership fee is collected on the basis of potential irrigable land at the rate of Rs 1 per katha (or Rs 30 per hectare). Distribution of share membership to the beneficiaries by WUA was started from 1996.

The share membership was distributed up to February 1998 prior to election and it is not distributed so actively now a days. The record of membership to that date is 5935 households out of 10154 households in western canal and 1106 households out of 1459 households in Piparpati Parsauni. However the collection of fee on the basis of irrigation land is Rs.88000 (land area of 2933 ha). The collection of membership fee in WUA of Piparpati-Parsauni is Rs 13565(land area of 452 ha). It has been learnt that all the water users haven't taken the membership. On the other hand, the shares taken by the farmers are not truly based on the land they own. General opinion of the farmers is that more share one has more ISF he/she has to pay. On the other hand one share certificate makes a farmer eligible to vote hence most of the farmers are more interested to become a voter. The farmers do irrigate their plots as per the water availability irrespective of the number of shares they hold. This has adversely affected the institutional functioning as well as the farmers' faith on the WUA functioning. WUA hasn't been able to increase the number of members as well as to generate more resources for O&M of the system.

Table 4.34: Status of Membership in NWGCIS

Status of membership in NWGCIS								
S.N.	Canal	Total households	Member	Accomplishment in percentage	Irrigated area in ha	Target member fee in Rs.	Member fee collected in Rs.	Accomplishment in percent
1.	NWGCIS	10159	5935	58	6160	148800	88000	48
2.	Piparpati Parsauni	1459	1106	76	922	27660	13565	49
Total		11618	7041	61	7082	212460	101565	48

Source: Semi-annual Report no. 8, IMD

F-2 Resources Collection

The financial resources of WUA in this system are following:

F-2A Irrigation Services Fees (ISF)

The collection of irrigation service fee (ISF), which can be considered the main source of income, was initiated way back from 2050/50 BS in those transferred branch and minor canal systems. Each individual beneficiary farmer of the service area has to pay the ISF to the WUA for getting irrigation service from the canal. The dates on which different minors and branches were handed over to the respective WUAs is given in Annex-4.7.

Two types of ISF collection mechanisms have been adopted so far.

A. Autonomous Collection System

When different branches, minors and MCs were handed over to the respective WUA committees, these committees were more enthusiastic rather than the main committee. Therefore, they themselves prepared the ISF collection receipts, collected ISF and spent on their own. But there was neither any established recording system nor any kind of control mechanism in this matter. Many irregularities were observed. Infact, some persons were appointed to do this job on salary basis. Many did not get the full account of money being raised. Although bank accounts are opened for that purpose, but there were numerous cases of delinquencies in this aspect. In some of the cases, the money being raised was not enough to pay the salary.

B. Decentralized collection system

The WUA main committee forwarded different approaches to collect the ISF learning from the instances of autonomous ISF collection system. It provided all needed receipts to Upa-tolis (tertiary level WUA) and they were authorized to collect the ISF. Since the canal management work force (CMWF) members of each Upa-toli committees were performing (or expected to perform) to maintain the water delivery as well as to list out the irrigated areas records, so it was thought to be convenient to collect the ISF through persons, rather than other committee persons. It was decided that the person who collects ISF would receive 20% from the collected amount as the remuneration for the work done. Paying remuneration on the basis of percentage of collected amount was found more effective as compared to paying the monthly salary to ISF collector.

The WUA main committee has distributed ISF collection receipts to all the Upa toil committees. Since 1998, the main committee has been collecting the share of ISF it would get or the record of receipt. However, the detail account is not yet ready. The study team couldn't get a clear picture of ISF collection in NWGIS for the duration since 1997 (when the system was handed over to the users) till date.

In Parsauni Minor, the Toli committee has been quite effective in terms of collection of ISF including the dues of previous years. One of the reasons for this can be attributed to better water availability in Parsauni Minor (as it gets directly water supply from Indian Canal). It is known that, in some other committees they have already collected ISF from the farmers and they are on their way to deposit in the main committee.

In middle and tail reach areas, it is known that there has been no activity of raising ISF so far. The reason is said to be the lack of coordination among the executives of WUA and CMWF members. In some cases committee's members are very inactive and they do not want to initiate these activities. The table 4.35 presents the record of collected ISF as of July 1999.

Table no. 4.36: ISF Collection in NGWCIS

S.N.	Name of WUA Committee/Branch	Command Area Ha.	Irrigated Area Ha.	Collection Target Rs.	Collection Progress. Rs. (As of July 1999)
1.	MC 1	41	39	2340	1200
2.	SFD 1	11	21	1260	
3.	SFD 2	13	7	420	2500
4.	MC 2	63	51	3060	
5.	MC 3	92	72	4320	400
6.	SFD 3	13	17	1020	
7.	Chhiwani water course	124	110	6600	
8.	MC4	121	79	4740	
9.	SFD4	20	96	5760	
10.	MC5	134			
11.	Visnuganj Br.	1321	1009	60540	1400
12.	MC6	46	32	1920	1300
13.	MC7	177	69	4140	2000
14.	MC8	34	23	1380	1000
15.	MC9	87	55	3300	100
16.	MC10	94	65	3900	4000
17.	Manjhariya Mnr.	1225	989	59340	5000
18.	MC11	73	56	3360	1000
19.	Nandapur Mnr.	369	241	14460	2500
20.	MC12	28	36	2160	
21.	Bhujahawa Br.	1151	644	38640	5000
22.	Shankapur Mnr.	392	295	17700	
23.	MC15	22	15	900	200
24.	MC16	42	25	1500	300
25.	MC17	36	46	2760	500
26.	MC18	38	23	1380	
27.	MC19	24	19	1140	
28.	MC20	32	21	1260	
29.	Piparhawa Br.	1097	997	2600	26.5
30.	SFD 5	9			
31.	MC21	46	27	1620	253
32.	MC22	84	35	2100	500
33.	MC23	38	42	2520	
34.	MC24	22	33	1980	
35.	Palhi Mnr.	189	169	10140	
36.	Gerrni Mnr.	249	211	12660	
37.	Bhagatpurwa Mnr.	240	181	10860	500
38.	Ragarganj Mnr.	246	199	11940	
39.	MC25	47	43	2580	210
40.	MC26	25	49	2940	
41.	SFD 6	20	19	1140	
	Sub Total of NGWC	**8135**	**6160**	**369600**	
42.	Piparpati Mnr.	1000	515	115875	
43.	Parsauni Mnr.	600	407	91575	
Sub Total of Piparpati		**1600**	**922**	**207450**	
Grand Total		**9735**	**7080**	**577050**	**29890**

Source : Semi-Annual Report no. 8, IMD

The ISF collection in NWGIS has been reported to be very low.
Similarly Table 4.37 shows the record of resource mobilization by WUA of NWGIS.

Table 4.37: Resource Mobilization by WUA of NWGIS (in NRs. '000)

Year	Govt. fund for O&M	ISF		Forest resources	Road taxes	Land Revenue
		Collection	%			
1993/1994		124.44	21.5			
1994/1995		87.05	15.08			
1995/1996		98.4	17.05			
1996/1997		185.66	32.17			
1997/1998	850.0	97.34	16.86	143.3	62.67	37.2
1998/1999	1250.0	29.89	5.18	65.72	43.73	16.22
1999/2000	1600.0	0	0			
2000/2001	1700.0	0	0			
2001/2002	1000.0	0	0			

It is interesting to see here that government is the sole contributor for the O&M of the irrigation system even after the system was formally handed over to the users. . The tenure of then main committee was over in 1997/98. The outgoing Main Committee of WUA couldn't call general assembly because of number of cases were registered against the members of the committee. General farmers were not happy over the performance of their representatives. Though some progress had been observed in terms of resource mobilization on the part of WUA during the years of 1996/97 and 1997/98, the WUA remain totally defunct after 1998/99.Consequently the irrigation systems were not maintained and this led to the poor performance of irrigation system institutionally as well as physically. From 2002, CDO of Nawalparasi formed an ad-hoc committee to look after the regular functions of WUA and to call a general assembly to form main committee of the WUA. The farmers are in a process of electing a new WUA in NWGIS.

F-2B Share Membership fee Collection

As mentioned above all the beneficiary farmers have to be the member of WUA. The WUA has fixed the rate for share membership fee, which is collected, and deposited in the account of WUA as the fixed deposit. Therefore it is also the source of income for the WUA. The WUA has decided that the share membership fee would not be spent for the petty reasons. So, this money is deposited in a fixed account that would be used only during emergency purpose. The WUA has reported that, the money collected from this membership is Rs 88000 as of 1999.**F-2C**

F2-C Other Financial resources

In West Gandak there are other financial sources as well, which the WUA main committee has access. They are as following;

A. Tree concession: There are about 2 lakh of trees (Sisou) of different age groups (5-15yes) along the right of the way of main canal and banks of the rivers. The trees have been handed over to the WUA. The WUA have sold the dead trees to the users at a rate fixed by the meeting of WUA with the representative of forest office and representative of CDO office. The rate was Rs 100 per quintal. Training for main committee members was held to teach them how to calculate the size of the tree by the forest technician. The government has authorized the WUA the responsibility to

dispose dead trees and collection of revenue from that for the benefit of the WUA. Table 4.36 has shown the different resources generated by the WUA.

B. Road Tax: There is a network of service road along canal system within the command area. The service road of main canal is used by other vehicles and other means of transportation as well. The WUA collects revenue as a road tax. The tax collected up to August 1999 is Rs 107000.

C. Market tax: These are several land areas along the main canal where the local people use then as market places. Rents are levied to the vendors. Right of raising the market tax is given to the highest bidder following an auctioning process. The main market centers where such market taxes are levied are Piprahiya, Belaspur, Gobrahiya, Majhauni, Sisahenia, Gopijung, Baruwa and Phechwa. The amount collected as market tax up to August 1999 is Rs 53800.

E-3 Conflict management:

Lately, there have been some changes in the constitution and a legal committee has been established under the executive manager. So far, very few cases are reported there in the main committee. There're having been only two cases of bank cutting. The head of legal committee wanted the offenders to mend the canal bank properly. Since they refused, the matter was taken to CDO and ultimately, the offender agreed to repair the canal bank as usual.

It is known that there were minor cases of breaching water distribution schedule, but such conflicts were resolved in the lower committee meetings or among the concerned farmers themselves.

In Parsauni Minor course, there is a specific rule and a fixed fine to the defaulter in the case of water stealing and canal cutting. One case canal cutting was recently resolved with a fine of Rs 500.

In Manjhariya minor, that there exists a case of canal land encroachment, but, so far, no resolution has been worked out to reclaim the land from the encroacher.

The analysis of the household survey information indicates that the conflict occurrence has been increased in the system (upper reach, the middle and tail reaches). Table no 4.38 presents the changes in occurrence of water related conflicts after the IMTP intervention. It is important to note that the occurrence of conflict at field level in tail reaches more often meant the water diversion between the channels, not among individual farmers at the field level.

Table no. 4.38: Conflict Occurrence in Different Reaches of NWGCIS (in percent)

Canal System	Conflict Occurrence			
	No conflict	Decreased a little	Not decreased	Increased
Bishnuganj Branch	3.0	11	37	49
Bhujhawa minor	5	9	25	61
Palhi minor	8	18	21	53
Bhagatpurwa minor	2	15	41	42
Parsauni minor	14	35	25	16

Sources : Household survey, IOE, May 2003

The results show that nearly half of the farmers feel that the occurrence of conflicts have increased after the IMTP intervention. This is mainly due to the fact that before the handover the authority was implemented rule through dictation of authority and the users would bide by the rule. But after the turnover of the system, the WUA with its weak functional strength couldn't adopt a strong measure to check the conflicts among the users. The survey results show that only 17% of the farmers feel that the WUAs are effective in resolving the conflicts.

E-4 Farmers Participation for O& M

Main canal and its control structures are operated by the CMWF appointed by the WUA main committee. Likewise, all branches, minors and MC/MFDs are also supposed to be operated by the assigned CMWF. But, it is not happening actually. In most of the cases, water entered in the branch and minor canals flows spontaneously. Farmers who need water operate the gates and control structures and irrigate the farm all on their own. In very few cases, the CMWF have operated the branch and minor canals.

Speaking of maintenance, the desilting works, the maintenance of service road and the essential structure maintenance were done by WUA executive committee. The head of the technical section of Executive committee with project overseer conducted jointly walk-through of main canal with the assistance of CMWF members. The identified works were then measured and estimates were prepared for those works. After that executive committee member carried out the work with the assistance of CMWF and office secretary following the working processes. Some Rs. 439,229 was spent for such maintenance works of which WUA spent Rs 375079 and 64150 was born by the project fund.

In the case branches, minors MC/MFDs along head reach area including the sample site of Bishnuganj and Bhujahawa, water course, maintenance activities are undertaken on equitable basis. The whole canal is measured and divided to all the farmers on the basis of their land holding size. The length of canal to be desilted is shared at the rate of 25-35 feet per Bigha. Farmers complete their job before the canal operation season begins. However, in middle and tail reach portion such organized system is not yet seen. Farmers on their own undertake desilting works as per need and interest.

If there is major breaching in the canal, the branch committee requests to the project for equipment and manages the fuel from the fund of the committee for that work. Records of the maintenance activities are maintained properly in main committee however it is not found accordingly in the branch and minor canals.

There is lack of enthusiasm among the user farmers to contribute for the O&M of the system. The survey results show that only 31 % of the farmers are willing to contribute readily for the maintenance of the system. Even 18% of the farmers reported that they don't even know that WUA has taken over the responsibility of management of the system. Similarly more than 65% of the farmers expressed their dissatisfaction over the transfer of management of whole system to the farmers. They opined that the farmers are able to manage up to the tertiary level of canal system and they need assistance from government to manage the branch and main canal system.

E-5 Capability development of WUA members.

Capacity of the WUA can be viewed as technical and managerial considering the nature of works that are to be performed. There have had been a number of training programs wherein the WUA executives and other technical group members such as canal management work force have learnt much on both management as well as operational and maintenance needs. They seem to be fairly capable in planning stage at least. But implementation has not been as per plans so far. In other words, say rules and procedures are established, but there has bee very weak implementation in the field.

In the case of lower tiers organizational as well as operation and maintenance capability seem relatively stronger and that has been found institutionalized in head reach. But in the middle and tail end position this capacity has been found relatively week. These are more organizational/institutional problems about the unity and integration among the members of the committee. There seems lack of leadership and process of consensus developing in irrigation matters. If they could develop organizational behavior the performance of the canal system and productivity of farm crops can be increased.

F. The Problems Identified

- Strong feeling of political groups among farmers even among the functionaries of WUA. Matter of concern is that the farmers have negative feelings toward the WUA and the representatives. They aren't happy over the complete take over of the system rather they preferred to take canal systems up to only the tertiary canals.
- The physical systems have been deteriorated due to the flood and poor maintenance. Some of the branches (Bishnuganj and Bhagatpurwa) were severely damaged by the flood and more than two thirds of the command area under the canal haven't received irrigation water since last 4 years. On the other hand siltation in the main and branch canals is one of the major maintenance problem. This demands large sum of resource to bring the canal system in the functional state. There lacks enough measure to check the siltation in the canals.
- There is quite noticeable lack of communication between the WUA main committee functionaries and the lower tier committee and general farmers.
- The users have lost faith in the functioning ability of WUA to manage whole system.
- Poor water management practices specially along mid and tail reaches of the system.
- Agricultural status of the system has deteriorated significantly leaving farmers less incentive to participate in O&M and also to pay ISF.

CHAPETR-V
ANALYSES ON THE IMPACTS OF IMPT ACTIVITIES AND POST TURNOVER DEVELOPMENT

Findings in each IMPT first phase irrigation systems viz. Pancha-kanya, Khageri and Nepal Gandak have been described in Chapter-IV. Here, it is endeavored to present such findings from the point of view of turnover as to what have been the positive developments and what have been other undesirable developments under the aftermath of turn-over to the respective WUAs.

The summary of the comparison of different attributes of irrigation systems for before and after IMTP scenarios are given in Table 5.1.

Table 5.1 Comparative Chart depicting before and after Situations of Turn-over of Phase I Sites:

S. N.	Aspect	Performance Indicators	Irrigation System	Before Hand over	After Hand over
1	Water Delivery System	1.Adequacy 2.Timeliness 3.Equity	Panchakanya Irrigation System	Discharge range was 850 to 1190 lit/sec in 1997. It was reported that there ware substantial seepage (50%) and conveyance losses due to poor maintenance. The water available was not adequate even for paddy cultivation in monsoon for half of the command area. The reliability of supply and equity of supply wasn't up to the satisfaction of the users.	Discharge range is similar at source. But, it is reported that there has been quite reduction of seepage (25-30%) due to repair and maintenance activities resulting in better flow to the fields. Though the water available is still not adequate for whole the command area, the improved canal system and the water distribution has led to facilitate the paddy cultivation in the area up to 450 ha. Nearly 50 ha of area at the tail end of the system which wasn't receiving irrigation water is now brought under irrigation. Major impact has been observed in terms of increased area under early paddy cultivation. The farmers have responded that the reliability and equity of irrigation water has improved significantly
			Khageri Irrigation System	Discharge range was 2520 to 6000 lit/sec But there had been no clear picture of water allocation among branches. The irrigation water wasn't adequate for 2200 ha due to excessive losses and wastage.	The Discharge data shows a little reduction in discharge at the head (5900 lit/sec). However, there is marked improvement in allocation to branches due to the physical improvements in the canal as well as improved water allocation and distribution mechanism. New allocation system has allowed two season irrigation to branch-1 and part of branch-2. This has added nearly 300 ha of command area under early paddy cultivation.
			Nepal West Gandak Canal Irrigation System	Discharge data show a high figure of 7563 lit/sec in 1993. The system wasn't able to draw the amount of water as per agreement between Nepal and India due to reduced capacity of main canal. Despite water at intake seems adequate for the command area poor condition of main and branch canals	The available discharge reaches a max of 4474 lit/sec. But currently, the WUA has been successful to get more supply through talks with Indian authority at Tribeni Barrage site. It has been reported that the adequacy of water supply had significantly increased during the time when system was about to be handed over to the users. At present the water availability has been significantly reduced due to the poor physical condition of the branch and main canals as well as the defunct status of the WUA.
2	Irrigated agriculture system	1.Area irrigated	Pachakanya Irrigation System	It was reported that about 300 ha used to get irrigation.	The irrigated area has increased year after year. Though it is estimated that 600 ha have been irrigated, the irrigated area with reliable water supply can be up to 450 ha. In the years of good monsoon whole command area can receive irrigation water for monsoon paddy. The irrigated areas for early paddy and other winter and spring crops have been increased by 20%
			Khageri Irrigation System	Although some reports presented that the command areas were in the order of 3900, but in actuality it was much lesser. The actual command area that used to get reliable water supply was at the range of 2000-2500 ha (as described by the farmer)	The irrigated areas have been increasing over the years after turn-over. At present the irrigated area for the monsoon season has been estimated to be around 3100 ha. Similarly the irrigated area for winter and spring season with reliable water supply has been estimated to be around 350 ha.
			Nepal West Gandak Canal Irrigation System	Though documents have stated that the previous irrigated area was 10300 ha. It is difficult to believe that whether the previously reported area were correct.	The irrigated areas had increased during the period of turn-over. Later on it has been reported that the area is decreasing over the years due to poor physical and water distribution system in NWGIS

3		Crop yield, intensity	Pachakanya Irrigation System	Early paddy cultivation was confined only at some patches in the head reach area. The yield of monsoon and early paddy were reported to be 3t/ha and 2.5t/ha	Cultivation of chaite paddy has increased significantly. Cropping areas of different crops were also increased. The cropping intensity is about 200 now. The yield if monsoon rice is about 3.5 t/m. Similarly the yield of early paddy has increased up to 3.4 ton/ha.
			Khageri Irrigation System	The overall cropping intensity was reported to be 184%. The yields of main and chaite paddy were 3.02 t/m and 2.5 t/m.	The study reveals a cropping intensity of 213%. There is quite a variation in yields from sample to sample for paddy and other crops as well.
			Nepal West Gandak Canal Irrigation System	No report on cropping intensity. However it was reported that the yield of paddy ranged 2 to 2.3 t/m.	The study reveals a cropping intensity of 187% The yield of rice ranges from 2.67 to 3.2 t/m.
4		Resources generation & mobilization	Pachakanya Irrigation System	Farmers involvement was not much. The ISF raised were minimal.	More than 90% active membership and more than 90% share certificate holders. Increased ISF and increased collection of ISF.
			Khageri Irrigation System	Farmers involvement was not much. The ISF raised were minimal.	The farmers are involved in resource generation mechanism. Though the efficiency of resource collection isn't up to the expectation, there is a strong potential of increased resource generation and mobilization
			Nepal West Gandak Canal Irrigation System	Farmers involvement was not much. The ISF raised were minimal.	ISF collection is in the range of 33 to 40%. Membership and share certificate distribution percentage accomplishment are in the range of 25 to 30%. Since 1998/99 the ISF collection has almost stopped. This has created a question over the financial sustainability of the irrigation system
5		Water distribution an maintenance	Pachakanya Irrigation System	No good wager distribution mechanism.	Water distribution is more systematic now
			Khageri Irrigation System	The project management had not been able to look after the water distribution schedule so well.	Water distribution in main is better followed as planned.
			Nepal West Gandak Canal Irrigation System	The project management had not been able to look after the water distribution schedule so well.	Water distribution at main is not that good as of now. But within the branch/minor, water users groups are doing well.
6.	Agricultural economic system	1.Gross revenue 2.Net value added 3.Net income to the farmers 4.Average labor productivity	Panchakanya Irrigation System	No details information available regarding the gross revenue, net value added and etc.	Despite the increase in crop productivity and crop yield, there seems not any increase in terms of gross revenue and net value added. Major reasons for such results are mainly due to higher increase in cost of production compared to the increase in production and price of agricultural commodity. On average the beneficiaries of the system mainly depend on non-agricultural income (75%). The changes in agricultural income hasn't really made much difference in the livelihood of the people in PIS
			Khageri Irrigation System	No details information available regarding the gross revenue, net value added and etc.	Despite the increase in crop productivity and crop yield, there seems not any increase in terms of gross revenue and net value added. Major reasons for such results are mainly due to higher increase in cost of production compared to the increase in production and price of agricultural commodity. On average the beneficiaries of the system mainly depend on non-agricultural income (71%). The changes in agricultural income hasn't really made much difference in the livelihood of the people in PIS
			Nepal West Gandak Canal Irrigation System	No details information available regarding the gross revenue, net value added and etc.	At present the cropping intensity, crop yield is reported to be lower than the items during the period when system was about to be handed over. From economic point of view the management transfer hasn't made any progress in terms of agricultural and other economic aspects of the farmers of NWGIS.

7	Institutional capability	1.Farmers participation 2.Resource mobilization 3 Membership	Panchakanya Irrigation System	Though farmers were involved to some extent in O&M of the system, there wasn't any proper system for their involvement and participation. There was much resource mobilization from the part of farmers for O&M of the system	Farmers have now a registered WUA with its clear role and responsibilities defined. The WUA has taken over the management responsibility of the system. Majority the water users are members and share holders of the system. PIS has been quite progressive in terms of resource generation and mobilization.
			Khageri Irrigation System	Farmers were hardly involved in O&M of the system. The resource mobilization was quite poor.	Farmers have a registered WUA with its defined role responsibility. The WUA has evolved into a strong organization. The branch canals are being operated and maintained by the concerned branch committees. Resource mobilization has been encouraging though not up to the expectation. Majority of the farmers are members of WUA and share holders of the system.
			Nepal West Gandak Canal Irrigation System	The WUA wasn't really functioning. There was little involvement of farmers in O&M. The system has history of very low collection of ISF.	A lots of efforts were put up in enhancing the capability of the WUA during IMTP. At present the WUA is almost defunct though its function was quite noticeable during the period of turnover of the system. Over the years after the system was handed over, the resource generation and mobilization in NWGIS is in decreasing trend.
8.	Sustainability	1. Physical 2. Financial 3. Institutional	Panchakanya Irrigation System	There was no question of sustainability as the system was supported by the government for O&M	From institutional point of view PIS is quite strong as it has a strong, transparent WUA on which almost all the farmers have strong trust and commitment. Financially also the resources generated by the WUA for its O&M seems adequate for its regular O&M expenses. Physically the canal system is in good condition and the system and the command area isn't prone to flood or danger of damages from drain. Only the question of sustainability is raised because of decreasing water supply of PIS at the source.
			Khageri Irrigation System	There was no question of sustainability as the system was supported by the government for O&M	Physically the system is well designed with less number of structures to maintain and with less risk for damage from local drains. As the main canal is being maintained by the government, the WUA should be able to generate enough resources to maintain the branch canals and structures. Though some weakness in WUA has been noticed regarding the linkages with the branches and communication with the farmers, there is strong probability that WUA will over come its deficiency and evolve as strong and effective WUA. The inadequacy of water for irrigation in dry season is one of the serious constraint that limits the improvement of the canal system as well as the institution
			Nepal West Gandak Canal Irrigation System	There was no question of sustainability as the system was supported by the government for O&M	Physically the system has two major constraints for its sustainability. One is the higher concentration of silt in the water which causes heavy desiltation in the main and branch canals. The major part of maintenance covers the desiltation in the canal system. Secondly the system has quite large number of control and regulating structures which needs a large man power to operate as well as large sum of resources for its maintainance. On the other hand the branch canals and the command area is prone to flood and damage from the cross drains.

5.1 Discharge at various canal networks (e.g. headwork, main and branch canals)

It is apparent that the respective WUAs and the farmers in general seemed to have shown growing concern about the amount of discharge available at the source in all three turned-over systems. Invariably in all three systems, the WUA main committee seemed much eager to augment the available flow at the source through all possible means. For example, the WUA of PIS is voicing about the need of conserving water/spring at the source. They are thinking of lining the canal system as much as possible with the available financial resources that they have, in order to decrease the seepage and conveyance losses. The concern of WUA in KIS for diverting the water from Bagmara and Chitwan Lift Irrigation Scheme do not require any elaborate mention here. In the case in NWGCIS is the office have approached to the Indian controlled barrage authority in such effective manner that the gate operation is now as per their request thus increasing the flow in their system.

5.2 Actual irrigated area in dry and wet seasons

There are reasons to believe that the actual irrigated areas in all seasons have improved after the turnover in all three systems. This development could be attributed to the improved water availability and planned water distribution schedule developed by the respective WUAs. One important aspect of the improvement that has been noticed during the study that the systems had shown significant improvement during the period of handover but such improvements couldn't sustain over the period of time. Specifically in NWGIS, the condition at present has been observed to be worse than the condition prior to IMTP

5.3 Agricultural status

It is evident that the cultivation of spring paddy has increased in PIS. However, the available records and limited field survey do not produce sufficient evident to state that there're having been increases in crop yield per unit areas of major crops. But there do have general feeling of more production judging from the amount of cereals taken to the market places by the farmers of the command area of PIS. The same is true about the KIS and NWGCIS.

5.4 Water distribution system

In PIS, the water distribution from the main canal to branches is certainly improved. However, there still remains some conflicts at the individual branches specially at the tail portions as no specific personnel is there to supervise the planned water distribution schedules. In KIS also, the case is similar, some efforts have to be exerted in streamlining the water distribution activities along branches and minors. In NWGCIS, the case is different. The recent situation revealed that due to unsatisfactory working of main committee, the water distribution from the main canal to the branches and minors is irregular. This is also because of poor repair/maintenance activities. But with in branches and minors, the water distribution systems are better established.

5.5 Maintenance of Physical system

Although it is evident that the canal systems have had much renovation just prior to turnover, for that reason also, the canal system seemed in better shape specially the PIS. Since the KIS and the NWGCIS are bigger systems and also because of considerable damage by floods, there are several places to be found out where repair/maintenance activities are needed right away. Apart from that, in general, the canal maintenance is now better planned with more equitable and strict rules of labor contributions. It is also seen that adherence to such rules were impressive enough

in PIS, head reaches of KIS and NWGCIS which would mean those places where irrigation is much more assured.

5.6 Institutional strength of WUAs.

It is evident that the institutional strengthening process and procedures of IMPT have had very direct impacts in all sites. There has been much mobilization of water users in terms of organization development followed by formulation of rules and regulations. Holding of meetings, elections, record keeping, etc have assumed regular activities now. In other words, the development of capability of governance or administration of the WUA as an organization, in general, is very remarkable.

However, the perception of such an effective WUA is not strong in case of Khageri and Nepal Gandak as compared to a comparatively smaller system. Panchakanya among the general farmers of their respective command area. But, it is found that the activities at the main committee level in Khageri and Nepal Gandak are no less though. There is evidence of several activities to prove that fact. It is a different matter that lots of decisions taken at the WUA are yet to be seen in practice in the field and lots or rules being developed are to be implemented.

The study revealed that the farmers in NWGIS have voiced against the activities of the WUA main committee. They have accused the executives of being indulgent in party politics, non-transparency of account suspecting mis-management of funds and irresponsible in matters needed to attend the system's operation and maintenance.

Speaking of fund raising activities it is good in PIS and can be hoped to be better in future. In KIS, the situation cannot be said to be better at this juncture in the matters of ISF and other fund raising issues. There is lack of communication between the main committee and the branch/minor committees and further down level groups. But the efforts being exerted by the main committee at this hour are encouraging and can be thought to bring better result in coming years. The situation in NGWIS is discouraging and some immediate measures to alleviate the current undesirable developments are awaited as early as possible.

5.7 Economic evaluation of the investment

The difference in net incremental benefit per year after the IMTP intervention in PIS was calculated to be NRs. 457, 420.0 against the investment of NRs. 7924727.0. The EIRR of the investment is computed to be about 1.5%. This shows that the investment made on physical improvement of the system couldn't be effectively translated in enhancement of agricultural performance and in increased economic return. Similarly the difference in net incremental benefit per year after the IMTP intervention in KIS was calculated to be NRs. 1156676.0 against the investment of NRs. 32978165.0. The net present value for investment against the discount rate of 2% has been found double than the net present value of the benefit. EIRR of the investment is obviously negative. The case of NWGIS is even worse regarding the economic evaluation of the investment. The difference in net incremental benefit per year after the IMTP intervention in PIS was calculated to be negative. The agricultural benefit after the IMTP is less than the benefit prior to IMTP by 32,406,478. There was no point in computing EIRR in case of NWGIS. In conclusion, the return on investment isn't really encouraging and it raises serious concern over the implementation of programs like IMTP.

CHAPTER - 6
DISCUSSION ON POLICY AND APPROACH OF IMTP

6.1 General Discussion

There are indications to conclude that there have been increases in agricultural productions which can be related to improved water availability as well as distribution. In Panchkanya, the increased cultivation of spring paddy is an example. The increased sales volume of paddy grown in spring and monsoon, as reported by the farmers, is a clear indication that there has been increase in production. Similar is the case in Khageri. The command areas of two blocks at the head reach are cultivated with spring paddy. These increased yields or production of crops can be attributed to better water management practice- as farmers get water timely for seedling raising, transplanting, and during the time of dry period, then their crops perform well. They value the irrigation water that way. It is often noted that once farmer's sense that there would be sufficient water then they would go for more area of cultivation. So the additional yield and production come from additional cultivation which comes as a result of water adequacy which is also a factor of better water management.

However, it is also to be noted that the yield per unit area may not increase only by taking into account a good water management practice. It is needless to state here that the ultimate increase in yield per unit area(Productivity) depends upon many factors particularly seed quality, cultural practices, plant protection measures, climatic factors, application of fertilizers and availability needed soil moisture.

It is possible that the data on cropping intensity and yield per unit area could give wrong signal of crop performance or overall crop production situation. This means that ultimate increase or decrease in crop production may not be the indicator of a good or bad water management practice alone which is a sad one for professional engaged in irrigation sector and having to evaluate the performance of irrigation in terms of crop production or productivity. It is difficult to assess the impact of irrigation on the basis of insurance to crop failure from draught. Like wise, it is difficult to collect entire crop production data of certain command area, otherwise such data could be usefully co-related with the extent of irrigation being provided to the targeted command area.

6.2 Question of Organizational sustainability

It is needless to state that the role of executives at the main committee is very importance. We see vividly the dedication, interest of the president and secretary has been quite instrumental in the good performance of the WUA and farmers in general. They devote much of their time and effort regularly. But the irony is that we cannot think of a provision where they get some kind of remuneration for what they do. Although we hear them say sometimes that what we get from all this work as they have to give significant amount of time in the WUA business. So the question here is not of a structure of organization or but of having dedicated and honest persons working for the sake of fellow farmers. Arranging for some kind of remuneration in cash or kind would

at least give some incentive for the WUA executives. But care should be taken, that such incentives shouldn't be the only motivating factor for the farmers to get into WUA. So, it seems that the organizational sustainability is so much influenced by the prevailing norms and values of the society.

The implementing agency, DOI, felt that the trainings would enhance the capability of the farmers and their representatives but no proper evaluation of the capability of the WUA was assessed. The trainings do have their inherent limitations and all the institutional building activities do not fit in a time bound program like IMTP. Hence extreme care should be taken while handling the people and institutions.

6.3 Significance of Turnover

It is apparent that the approach of turning over irrigation system completely in the hands of farmers is not without some residual thought in our conscience. What is the deep underlying motive behind such turnover modality? Is the government thinking of money alone as the deciding factor? Or the top authority thinks that the bureaucracy can not be streamlined to work as per needs of the common farmers? In the pursuit of improving the performance of irrigation system in terms of water distribution as well as sustainable operation and maintenance, seeking the greater role of water users is genuine. But, postulating scheduled turnover activities, not assisting or nominal assisting in terms of financial matters after that should not be the basic idea. The government needs to be willing to spend money to turn over systems as well. The money should not be the deciding factor. It has not been forgotten that the agriculture is a prioritized sector and the government needs to play its responsible role any way.

Turn-over approach should be viewed as modality of getting (i) Increased participation of farmers in managing the irrigation system (ii) increased resource mobilization in terms of cash and kind needed for O&M.

Another important consideration behind such approach should be the development of capability of WUAs in water distribution activities. Because, we must understand that water distribution is something which needs spontaneous attendance and which is possible only at farmer's level. No government involvement could be that effective, but there is much efforts needed to instill much technical skill needed in this aspect to the farmers.

So, turnover strategy should be taken as a development approach for materializing a sustainable and better-performed irrigation system. What developments follow turnover is another aspect and further corrective measures need to be thought out and executed thereafter. Judging on the post development of turnover and then evaluating whether the turnover approach was right or wrong is not appropriate idea.

CHAPTER – VII
CONCLUSION, SUGGESTION AND RECOMMENDATIONS

Conclusion

Benefits of IMTP activities can be listed as following in as much as appeared from the study of phase – I irrigation systems:

i. The WUA formation processes, procedures and institutional development from the point of view of needed O& M of irrigation system are some very prominent achievements of IMTP which must have contributed a sense of direction and confidence to the agency staff in their pursuit of management transfer programs in future.

ii. Some of the undesirable post transfer developments as witnessed in NWGCIS should be taken as lesson learnt from IMTP implementation and not something which deter the spirit of management transfer approach of he government. Actually, such lesson should be utilized to develop subsequent and more refined programs thereafter. For example, the politicizing of WUA provides a food for thought for institutional development specialist as well as policy makers as to what could be the solutions to such developments. Or what types of activities are to be included in post-transfer support program by the agency. From that perspective, even such undesirable developments can be assimilated as outcomes of IMTP.

iii. At field level, IMTP activities have been instrumental in (I) establishing organization of farmers for O&M of Irrigation systems (ii) getting increased participation of farmers in O&M of irrigation systems (iii) getting increased resource mobilization (iv) increasing awareness among the farmers, generating ownership feeling as well as the mobilization and conservation of water and financial resources.

iv. It is evident that the overall agricultural productions have increased in IMTP sites and that must have been due to better water management in ways of better crop insurance against draught or expansion of irrigated areas with increased water availability. It is however difficult to say that yield per unit area have increased since many improved agricultural practices are still missing in those command areas.

v. Judging from the participation of water users in maintenance activities now prevalent in IMTP systems plus the general awareness in terms of cost effective maintenance approaches, it is for sure, the capital expenditures for system maintenance would be lower in comparison to that before the turn-over situation.

Likewise, some of the visible short-comings of IMTP activities at this juncture can be listed as following:

i. In the question of rehabilitation need (or major repair and maintenance activities), it is noteworthy here that a very substantial amount of money is being spent before turnover

as a part and parcel of the IMTP program. That would mean that currently the systems are in better shape and may not require major repair budget for quite some time. The question here is – would the WUA be able to generate needed resources if there be need of such rehabilitation works? Actually, we see that there have been quite damages done by the floods this very season in NWGCIS and KIS as well. Perhaps, WUA would not be in a position to fix them as needed. So, as of now, it seems that the need of emergency maintenance has to be addressed crossing the IMTP concept.

ii. Critics of IMTP are stating that it has been pre-occupied with formulation of WUA and rehabilitation activities. This has come out to be true and signs are more prominent now than before. We witness there have been sharp weakness in WUA in the matters of water resource management as well as managing the resource mobilization. Some of the very important software in terms of water management and resource mobilization management has not been completed, as they should be before the turnover.

iii. It appeared that IMTP has been silent in some very fundamental issues such as the motivational aspects of office bearers of the water users associations. WUA is conceptualized based on complete voluntary contribution of its office bearers. In big systems like, NWGCIS and KIS, they have to spend very large portion of their daily hours in matters related to WUA. From the angle of transparency and sustainability, it is rather important issue. The intrusion of party politics in WUA of NWGCIS should be evaluated from this angle as well.

Suggestion and Recommendations

Based on the impact of IMTP so far, it seems that such program should not be done in tight time schedule basis. A joint management approach should be followed as long as it needs based on the situation of any individual irrigation system.

The agency should not think that its role or activities it is supposed to perform ceases after the event of turnover. On the contrary, it is evident that more activities are required there. Software activities such as water measurement, water resource management, resource collection administration should be profusely undertaken even after turnover. Apart from that, there has to be some efforts in bringing other stakeholders as well that contribute in increasing agricultural production.

Turnover of an irrigation system to WUA is compared to a bride being sent to her bridegroom's house. There still exists a relation between the agency and the WUA that surfaces more prominently at the times of need.

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ANNEXES

Annex - 1

IMTP Irrigation Systems

Annex 2.1

A-2.1.1 Personnel Involved During Field Visit and data input to the computer

(i)	Dr. Narendra Man Shakya	:	Team Leader/Irrigation Engineer
(ii)	Dr. Sandhya Basnet	:	Sociologist
(iii)	Dr. Basant Bickram Thapa	:	Agricultural Economist
(iv)	Dr. Kishor Raj Panta	:	Irrigation Engineer
(v)	Er. Ambikesh Kumar Jha	:	Irrigation Engineer
(vi)	Enumerators		
(vii)	Facilitators		
(viii)	Mr. Shyam Khadka	:	Computer Operator

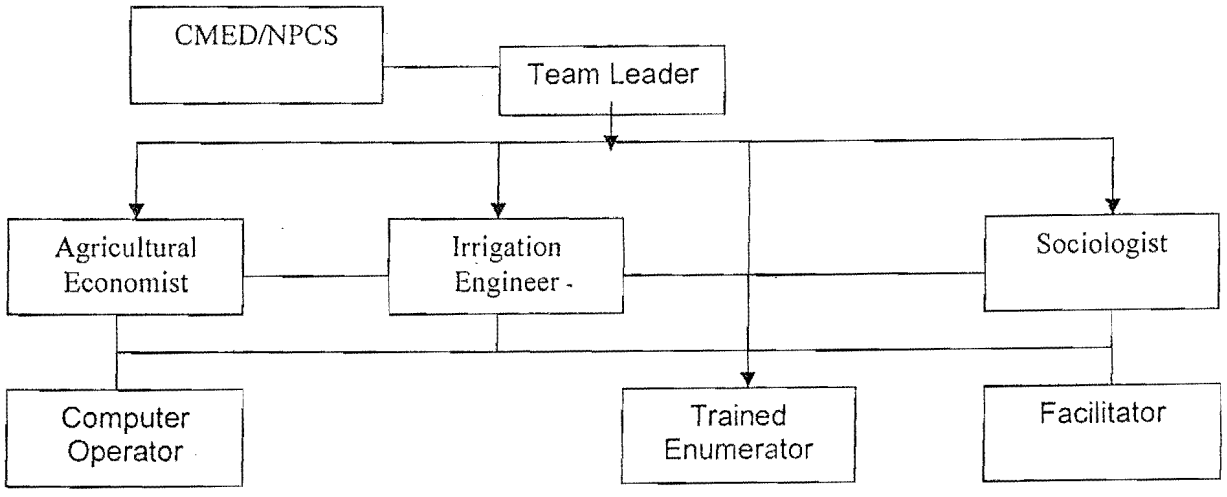
A-2.1.2 List of Enumerators involved during the work

The list of enumerators involved during the field work including their respective involvement at various locations and irrigations are mentioned in the table below:

S.N.	Name	System	Branch
1.	Ganesh Pathak	Panchakanya	1 & 5
2.	Samir Joshi	Khageri & Panchakanya	Kahgeri 1 & Panchakanya 7
3.	Mohan Khadka	Khageri	1, 4 & 6
4.	Deepak Pandey	Khageri	4, 6 & 8
5.	Madan Prasad Dhawal	West Gandak	Bishnu Ganj
6.	Suchit Harizan	West Gandak	Bhagatpurwa & Palhi Minor
7.	Harendra Kumar Chaudhary	West Gandak	Bishnu Ganj
8.	Dharmendra Yadav	West Gandak, Indian Main Canal	Parsauni Minor
9.	Jogendra Chaudhary	West Gandak	Piparhawa
10.	Shyam Jit Gupta	West Gandak	Piparhawa

A-2.1.3 Organization Chart

The Organizational set up under the study is as follows:



2.1: Organization chart of the consulting team during the study

Annex 2.2: Check List for Farmers/WUA Group Discussion

1. **Physical System**
   - Physical improvements carried out by IMTP.
   - Responsible organization/individual for identifying and finalizing the type and kind of physical improvement.
   - Responsible organization/individual for taking care of quality and quantity control of the physical improvements.
   - Physical condition of the canals/structures after the improvement.
   - Physical condition of the canals/structures at present.
   - Availability of irrigation water adequately and reliably during different crop seasons after the physical improvement.
   - Problems and difficulties related to the physical functioning of the irrigation system.
   - Reasons for those problems/difficulties.
2. **Operation and maintenance**

   <u>Operation</u>
   - Operational mechanism (allocation and distribution of irrigation water) of the system being carried out.
   - Development of operational manual/ guidelines for the system.
   - Decision making authority for systems operation.
   - Working mechanism and work force for operation. Responsible monitoring authority of the operation.

   <u>Maintenance</u>
   - Type of maintenance works carried out
     - Regular maintenance
     - Periodic maintenance
     - Emergency maintenance
   - Maintenance plans prepared.
   - Decision making person/s and mechanism for maintenance activities to be carried out and maintenance scheduling.
   - Irrigation system maintenance procedures. Participation (both cash, kind and volunteer labor contribution) of the beneficiaries in the maintenance of the system.
   - Role of WUA and farmers in maintenance
   - Budgeting and management of maintenance expenditures.

3. **Agricultural System**

- Change in cropping intensity, cropping pattern, agricultural practice
- Introduction of modern agricultural inputs
- Change in productivity
- Change in farm income
- Change in know how or awareness agricultural practice

4. **Socio Institutional System**

- Status of WUA (registration, constitution, meetings, general assembly)
- Wide and representative representation of users in WUA from all areas and spectrum of the irrigation systems. Women representation and role in decision making. Attitudes of farmers toward WUA.
- Resource generation and mobilization for O&M and institutional activities. Efficiency of ISF collection
- Conflict resolution and other activities of WUA

5. **Others**

Annex 2.3: Name list of participants during Focus Group Discussions

Panchakanya Irrigation System			
Branch Number 1			
S.No.	**Name**	**Address**	**Remarks**
1	Shree Krishna Mahato	Ratna Nagar Municipility - 7	Outlet 1, 2, 3
2	Ram Chandra Adhikari	Ratna Nagar Municipility - 8	Outlet 1, 2
3	Bhupendra Adhikari	Ratna Nagar Municipility - 9	Outlet 1
4	Dharma Raj Acharya	Ratna Nagar Municipility - 10	Outlet 1, 3
5	Janua Mahato	Ratna Nagar Municipility - 11	Outlet 1
6	Giri Raj Poudel	Ratna Nagar Municipility - 12	Outlet 1
7	Bhawani Prasad Acharya	Ratna Nagar Municipility - 13	Outlet 1, 3
8	Ishwari Lamichane	Ratna Nagar Municipility - 14	Outlet 1
9	Chakra Pani Adhikari	Ratna Nagar Municipility - 15	Outlet 1
10	Tika Ram Acharya	Ratna Nagar Municipility - 16	Outlet 1
11	Dilli Ram Acharya	Ratna Nagar Municipility - 17	Outlet 1
12	Bishnu Prasad Regmi	Ratna Nagar Municipility - 18	Outlet 1

Panchakanya Irrigation System			
Branch Number 5			
S.No.	**Name**	**Address**	**Remarks**
1	Ramhari Mainali	Ratna Nagar Municipility - 6	Mohana
2	Shanta Acharya	Ratna Nagar Municipility - 6	Mohana
3	Devi Dutta Dhungana	Ratna Nagar Municipility - 6	Mohana
4	Bhumi Prasad Duwadi	Ratna Nagar Municipility - 6	Mohana
5	Kul Prasad Acharya	Ratna Nagar Municipility - 6	Mohana
6	Hasta Bahadur Basnet	Ratna Nagar Municipility - 6	Mohana
7	Dhananjaya Poudel	Ratna Nagar Municipility - 6	Mohana
8	Bhawani Dutta Chatkauli	Ratna Nagar Municipility - 6	Mohana
9	Raj Sharan Neupane	Ratna Nagar Municipility - 6	Mohana
10	Sdil Bahadur Basnet	Ratna Nagar Municipility - 6	Mohana
11	Arjun Dhungana	Ratna Nagar Municipility - 6	Mohana
12	Hom Nath Regmi	Ratna Nagar Municipility - 6	Mohana
13	Tilak Raj Poudel	Ratna Nagar Municipility - 6	Mohana
14	Prem Prasad Poudel	Ratna Nagar Municipility - 6	Mohana
15	Bishnu Hari Devkota	Ratna Nagar Municipility - 6	Mohana

Panchakanya Irrigation System			
Branch Number 7			
S.No.	**Name**	**Address**	**Remarks**
1	Mr. Balram Chaudhary	Ratnanagar Municipality - 4	Chairman
2	M/S Asha Chaydhary	Ratnanagar Municipality - 4	Secretary
3	M/S Geeta Chaydhary	Ratnanagar Municipality - 4	Treasurer
4	M/S Jiyani Chaydhary	Ratnanagar Municipality - 4	Member
5	M/S Baniya Chaydhary	Ratnanagar Municipality - 4	Member
6	M/S Jiyani Chaydhary	Ratnanagar Municipality - 4	Member
7	Mr. Madari Raut	Ratnanagar Municipality - 4	Member
8	Mr. Ram Kumar Chaudhary	Ratnanagar Municipality - 4	General Assembly Member
9	Mr. Ram Krishna Raut	Ratnanagar Municipality - 4	General Assembly Member
10	Mr. Nati Chaudhary	Ratnanagar Municipality - 4	Beneficiary Member
11	Mr. Jhotil Raut	Ratnanagar Municipality - 4	Beneficiary Member
12	Mr. Hathan Mahato	Ratnanagar Municipality - 4	Beneficiary Member
13	Mr. Chandra Dev Chaudhary	Ratnanagar Municipality - 4	Beneficiary Member
14	Mr. Dhidhari Raut	Ratnanagar Municipality - 4	Beneficiary Member
15	Mr. Bhaidai Chaudhary	Ratnanagar Municipality - 4	Beneficiary Member
16	Mr. Gangi Chaudhary	Ratnanagar Municipality - 4	Beneficiary Member
17	Mr. Arjun Chaudhary	Ratnanagar Municipality - 4	Beneficiary Member
18	Mr. Bharat Mahato	Ratnanagar Municipality - 4	
19	Mr. Mangan Mahato	Ratnanagar Municipality - 4	
20	Mr. Jay Ramr Chaudhary	Ratnanagar Municipality - 4	
21	Mr. Gudar Chaudhary	Ratnanagar Municipality - 4	
22	Mr. Suman Pant	Ratnanagar Municipality - 4	

Khageri Irrigation System			
Branch Number 1			
S.No.	**Name**	**Address**	**Remarks**
1	Min Raj Poudel	Ujjwal Nagar	Chairman Outlet - 1
2	Bishnu Prasad Adhikari	Dev Nagar	Polythene Pipe No. 2
3	Rohini Nath Neupane	Dev Nagar	Polythene Pipe No. 1
4	Badri Nath Koirala	Dev Nagar	Outlet No. 16
5	Baburam Sapkota	Dev Nagar	Narayani Irr.
6	Bishnu Prasad Adhikari	Dev Nagar	Outlet No. 9
7	Netra Prasad Neupane	Dev Nagar	Outlet No. 18
8	Laxmi Neupane	Dev Nagar	Outlet No. 4 & 5
9	Hom Nath Rijal	Dev Nagar	Outlet No. 9
10	Dipak Subedi	Dev Nagar	Branch Secretary
11	Apsara Sapkota (Regmi)	Dev Nagar	Gender Equity Motivator, Outlet No. 18
12	Phanindra Acharya	Dev Nagar	Outlet No. 20
13	Prakash Adhikari	Dev Nagar	Branch Vice-Chairman
14	Baij Nath Devkota	Dev Nagar	Branch Member, Outlet No. 9
15	Buddhi Sagar Bastola	Dev Nagar	Outlet No. 7
16	Arjun Kumar Sharma	Dev Nagar	Branch No. 0
17	Maiya Devi Chapagain	Dev Nagar	Polythene Pipe No. 2
18	Krishna Prasad Subedi	Dev Nagar	Outlet No. 17
19	Devki Koirala	Dev Nagar	Outlet No. 6
20	Gyan Hari Aryal	Ujjwal Nagar - 1	Polythene Outlet
21	Dipak Adhikari	Dev Nagar	Branch No. 1
22	Lekhanath Tiwari	Dev Nagar	Outlet No. 9
23	Murari Mohan	Bharatpur	Field Officer, SAGUN
24	Samir Raj Joshi	Bharatpur	Enumerator
25	Dipak Pandey	Bharatpur	Enumerator

Khageri Irrigation System			
Branch Number 4			
S.No.	**Name**	**Address**	**Remarks**
1	Laxmi Prasad Bhandari	Patihani - 4	Outlet No. 9
2	Chet Nath Neupane	Shivanagar - 8	Outlet No. 2
3	Balram Subedi	Shivanagar - 8	Outlet No. 2
4	Rudra Nath Koirala	Shivanagar - 8	Outlet No. 2
5	Raghunath Lamichane	Shivanagar - 8	Outlet No. 4
6	Shyam Bhakta Poudel	Shivanagar - 8	Outlet No. 4
7	Govinda Adhikari	Patihani - 4	Outlet No. 7
8	Ganga Bhandari	Patihani - 4	Outlet No. 13
9	Buddhi Prasad Gautam	Patihani - 4	Outlet No. 10
10	Bikram Pabe	Patihani - 4	Outlet No. 15
11	Dil Bahadur Gautam	Patihani - 4	Outlet No. 12
12	Bhakta Bahadur Kunwar	Patihani - 4	Outlet No. 19
13	Nanda Prasad Pande	Shivanagar - 7	Main canal Outlet No 2

Khageri Irrigation System

Branch Number 6 (West)

S.No.	Name	Address	Remarks
1	Hem Kant Kafle	Shiva Nagar - 4	Pipe No 2
2	Agni Dhar Dawadi	Parbatipur - 6	Pipe No 8
3	Siddhi Lal Shrestha	Parbatipur Purwa Rangila - 4	Pipe No 8
4	Dil Bahadur	Parbatipur - 9	Outlet No 18
5	Ananda Prasad Shrestha	Parbatipur - 5	Pipe No 7
6	Hem Prasad Adhikari	Parbatipur - 6	Pipe No 3
7	Narayan Adhikari	Parbatipur - 9	
8	Kamal Bahadur Thapa	Parbatipur - 9	Outlet No 20
9	Daya Ram Sapkota	Parbatipur, Kanchan Basti	
10	Raju Gurung	Shiva Nagar - 4	Pipe No 3
11	Min Bahadur Gurung	Shiva Nagar - 4	Pipe No 3
12	Shankar Raj Rajbhandari	Parbatipur	Chairman Branch Committee
13	Hari Prasad Koirala		Representative to Main Committee
14	Krishna Prasad Sodari	Parbatipur - 7	General Body Member
15	Anuradha Sudari	Shiva Nagar - 1	Main Pipe No 1
16	Bimala Adhikari	Shiva Nagar - 1	Main Pipe No 1
17	Kopila Aryal	Shiva Nagar - 1	Pipe No 3

Khageri Irrigation System

Branch Number 8

S.No.	Name	Address	Remarks
1	Chandra Nath Ghimire	Sharada Nagar - 5	Outlet 18
2	Singha Raj Gurung	Sharada Nagar - 9	Outlet 11
3	Punya Prasad Ghimire	Sharada Nagar - 5	Outlet 19
4	Makan Singh Lama	Sharada Nagar - 9	Outlet 14
5	Tak Bahadur Thapa	Sharada Nagar - 5	Outlet 12
6	Hari Prasad Timelsena	Sharada Nagar - 9	Tail
7	Dhundi Raj Gaire	Sharada Nagar - 5	Tail
8	Bal Chandra Ghimire	Sharada Nagar - 5	Outlet 18
9	Hari Krishna Rijal	Sharada Nagar - 9	Outlet 17
10	Ambar Nath Dhakal	Sharada Nagar - 5	Outlet 16
11	Chandra Kant Ghimire	Sharada Nagar - 5	Outlet 18
12	Dil Bahadur Tamang	Sharada Nagar - 5	Outlet 19
13	Yadu Nath Lamichane	Sharada Nagar - 9	Outlet 16
14	Lok Bahadur Gurung	Sharada Nagar - 5	Outlet 19
15	Tej bahadur Gurung	Sharada Nagar - 5	Outlet 19
16	Lila Ram Ghimire	Sharada Nagar - 5	Outlet 19
17	Narayan Ghimire	Sharada Nagar - 5	Outlet 19

Nepal West Gandak Irrigation System (Indian Main Canal)			
Parsauni Minor			
S.No.	**Name**	**Address**	**Remarks**
1	Megh raj Khawash	Guthi - 5	
2	Surendra Yadav	Guthi Suraj Pura - 5	
3	Suresh yadav	Guthi Suraj Pura - 5	
4	Ram Ashare	Guthi Suraj Pura - 5	
5	Ram Lakhan Kewat	Guthi Suraj Pura - 5	
6	Radhe Shyam Sonar	Guthi Prasauni	
7	Rabindra Mallik	Guthi Suraj Pura - 6	
8	Ama Sufi	Guthi Suraj Pura - 5	
9	Binod	Guthi Suraj Pura - 5	
10	Dhanne Khawash	Guthi Suraj Pura - 5	
11	Prem Yadav	Guthi Suraj Pura - 5	
12	Akad Khawash		
13	Sunarpati Bhukha	Guthi Suraj Pura - 5	
14	Darbari Yadav	Guthi Suraj Pura - 5	
15	Abita Mallik	Guthi Prasauni	
16	Mukh Lal Yadav		
17	ubhash Yadav		

Nepal West Gandak Irrigation System			
Bishnuganj Branch			
S.No.	**Name**	**Address**	**Remarks**
1	Satya Narayan Chaudhary	Pratappur -3	
2	Ram Dhari Kewat	Pratappur -2	
3	Gaya Prasad Nagarkoti	Pratappur-3	
4	Bilar Sharma	Pratappur-3	
5	Khila Prasad Chaudhary	Pratappur-3	
6	Sher Bahadur Chaudhary	Pratappur-3	
7	Narendra Kumar Yadav	Pratappur-2	
8	Gopal Sharma	Pratappur-4	
9	Madan Prasad Kewat	Pratappur-3	
10	Chhote Lal Dhawal	Pratappur-2	
11	Kamala Barai	Pratappur-4	
12	Akad Khawash	Pratappur-2	
13	Ramji Shing	Pratappur -4	Branch Chairman
14	Satya Narayan Chaudhary	Pratappur -4	Branch secretary
15	Shiva narayan Chaudhary	Pratappur -6	
16	Ram Narayan Yadav	Surya pura-4	

Nepal West Gandak Irrigation System			
Piparhawa Branch			
S.No.	**Name**	**Address**	**Remarks**
1	Prahlad Kurmi	Mudera-8	
2	Gauri Shankar Teli	Kusma-4	
3	Bishmilla Darji	Kusma-3	
4	Mustafa Darji	Mudera-4	
5	Brahma Kewat	Kusma-3	
6	Harihar Kewat	Kusma-3	
7	Suresh Yadav	Mudera-8	
8	Pancham Chamar	Mudera-8	
9	Binod Yadav	Mudera-6	
10	Daya Ram Chaudhary	Kusma	Branch Chairman
11	Krishna Jiwan Tiwari	Kusma	Ex Branch secretary
12	Mangan Chaudhary	Kusma	

Nepal West Gandak Irrigation System			
Palhi Minor			
S.No	**Name**	**Address**	**Remarks**
1	Ram Narayan Chaudhary	Palhi	
2	Baij Nath Chaudhary	Palhi	
3	Shital Mali	Palhi	
4	Mukur Giri	Palhi	
5	Ram Briksha Kewat	Palhi	
6	Sumitra Kewat	Palhi	
7	Amrita Kundu	Palhi	
8	Subhash Chandra Kaushal	Palhi	Ex Branch secretary
9	Jawahar Lal Kaushal	Palhi	
10	Ram Bilas Gupta	Palhi	
11	Mani Ram Sharma	Palhi	
12	Baija Nath Gupta	Palhi	Ex Branch Chairman
13	Raj Kishor Sonar		
14	Bajarangi Lal Sonar		

Annex – 2.4

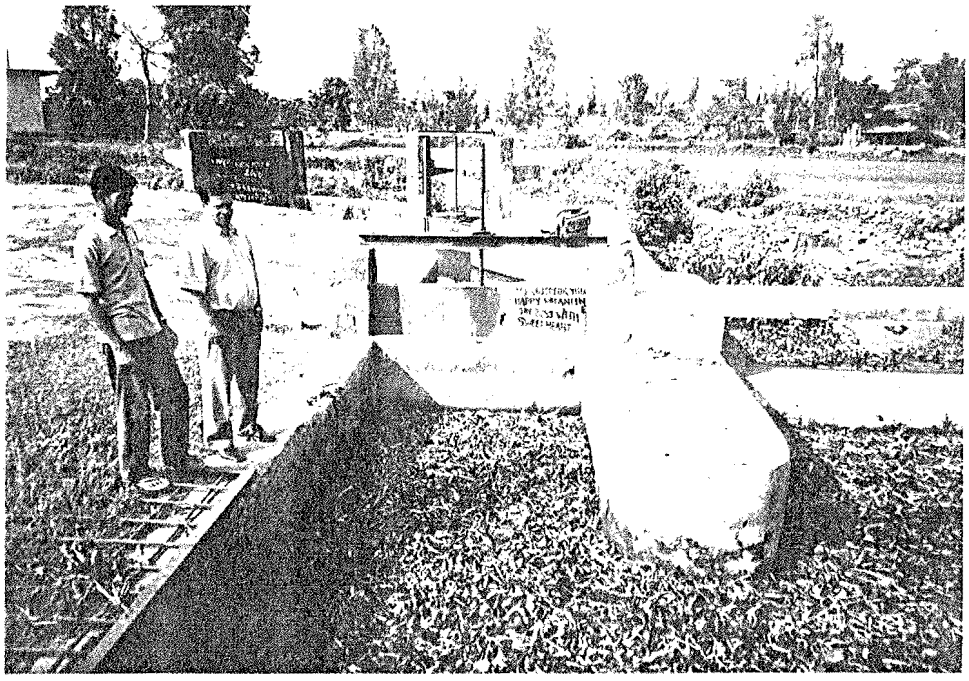


Photo – 1: Water weed at intake
Panchakanya Irrigation System

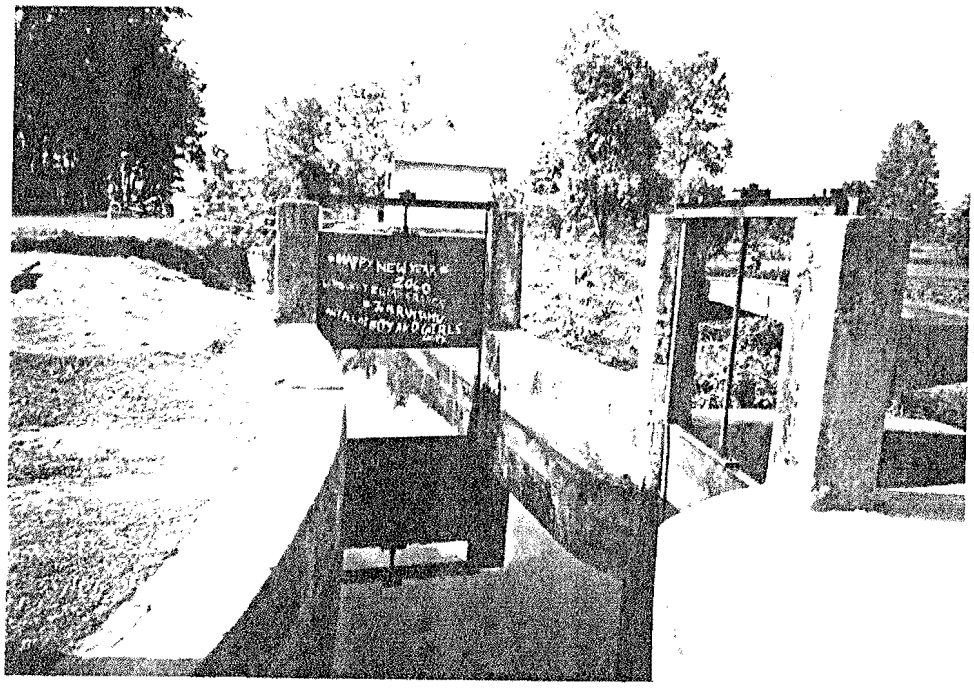


Photo – 2: Escape and head regulator at intake of
Panchakanya Irrigation System

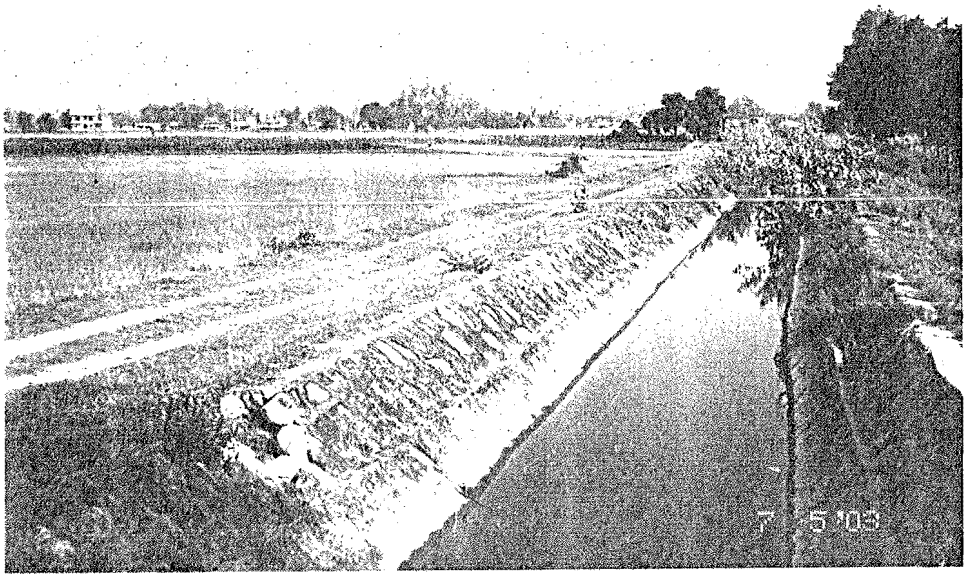


Photo – 3: Lined canal of Panchakanya Irrigation System North of Highway

Photo – 4: Local Materials used as check regulator along Panchakanya Irrigation System

Photo – 5: Lined section damaged in branch - 1
Panchakanya Irrigation System

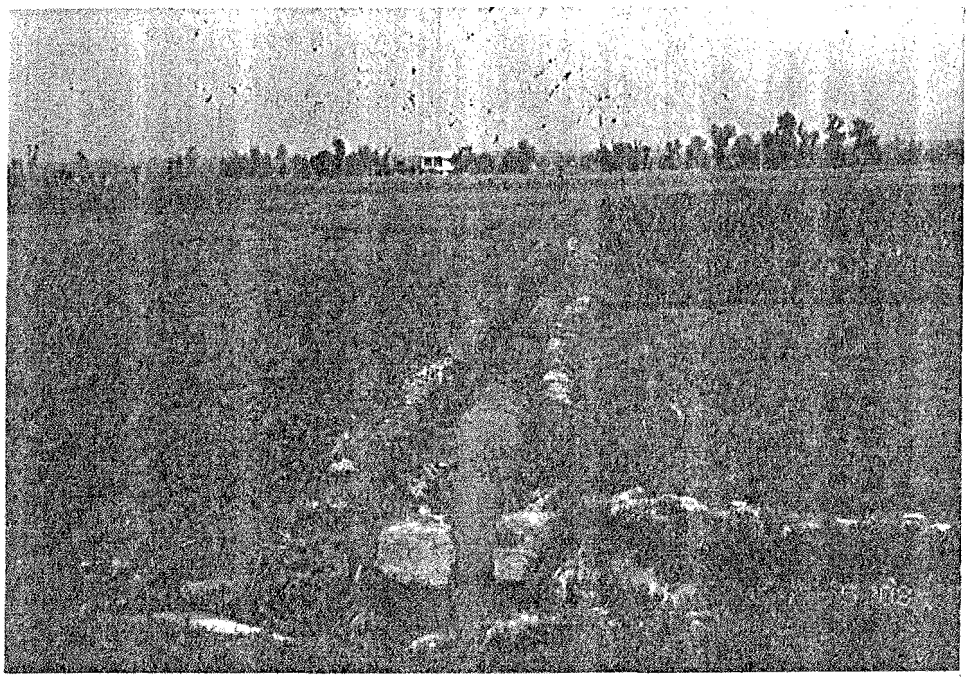


Photo – 6: Maize crop being irrigated at branch - 3
Panchakanya Irrigation System

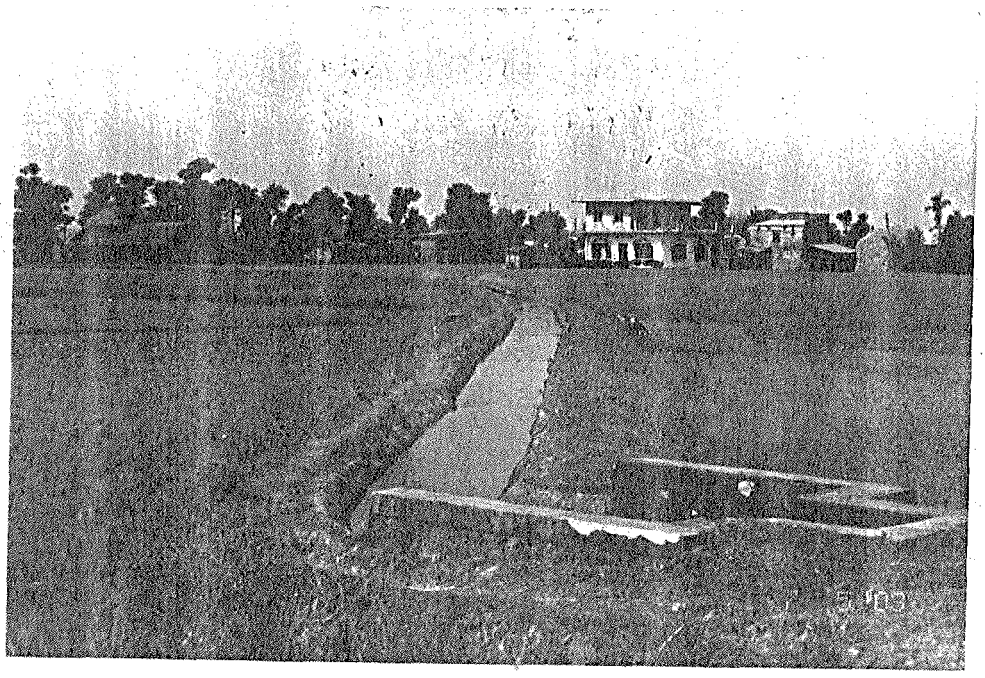


Photo – 7: Seepage along side of lined canal section (branch – 5) Panchakanya Irrigation System

Photo – 8: Poorly maintained canal at tail end main canal Panchakanya Irrigation System

Photo – 9: Canal bank cut almost vertical at side (branch – 7)
Panchakanya Irrigation System

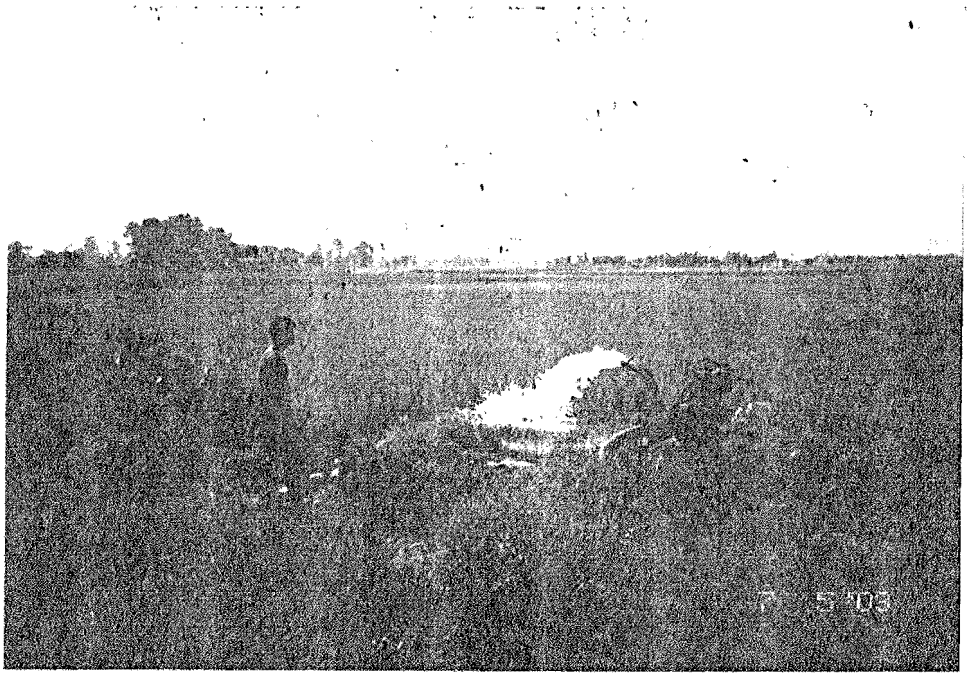


Photo – 10: Early paddy being irrigated at farmer's plot near by branch – 1
Panchakanya Irrigation System

Photo – 11: WUA main committee discussion
Panchakanya Irrigation System

Photo – 12: Group discussion in branch – 5
Panchakanya Irrigation System

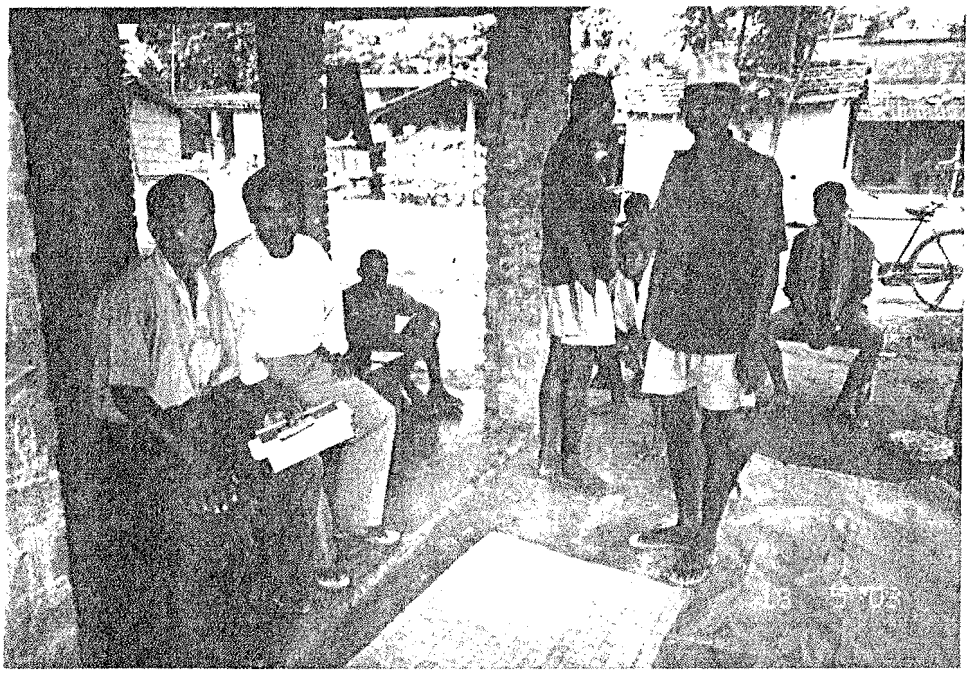


Photo- 13: Group discussion in branch – 7
Panchakanya Irrigation System

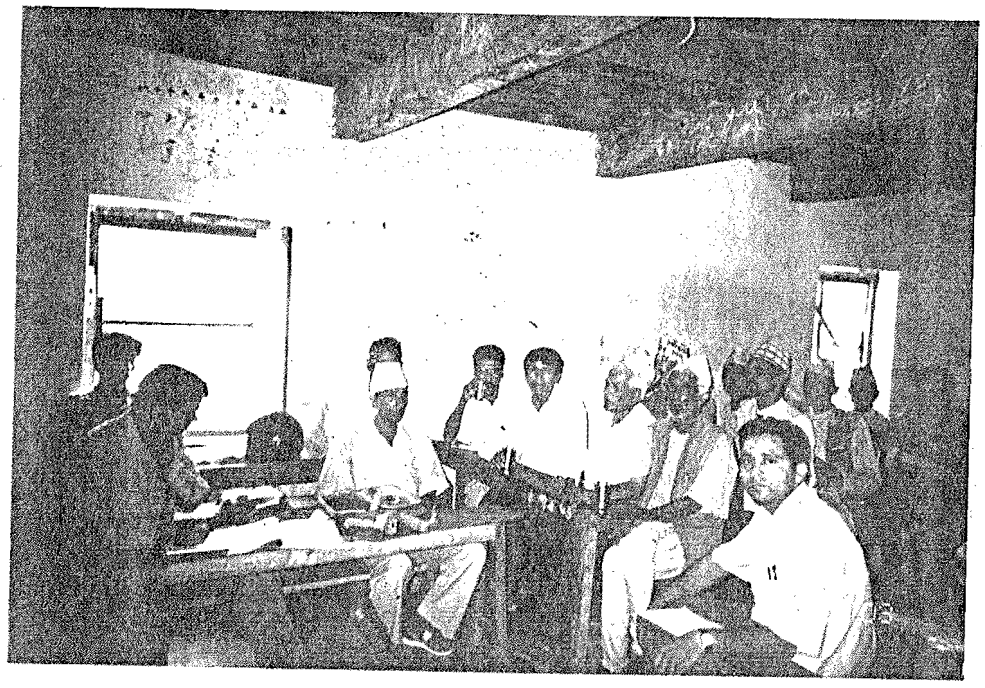


Photo – 14: Group discussion branch - 1
Khageri Irrigation System

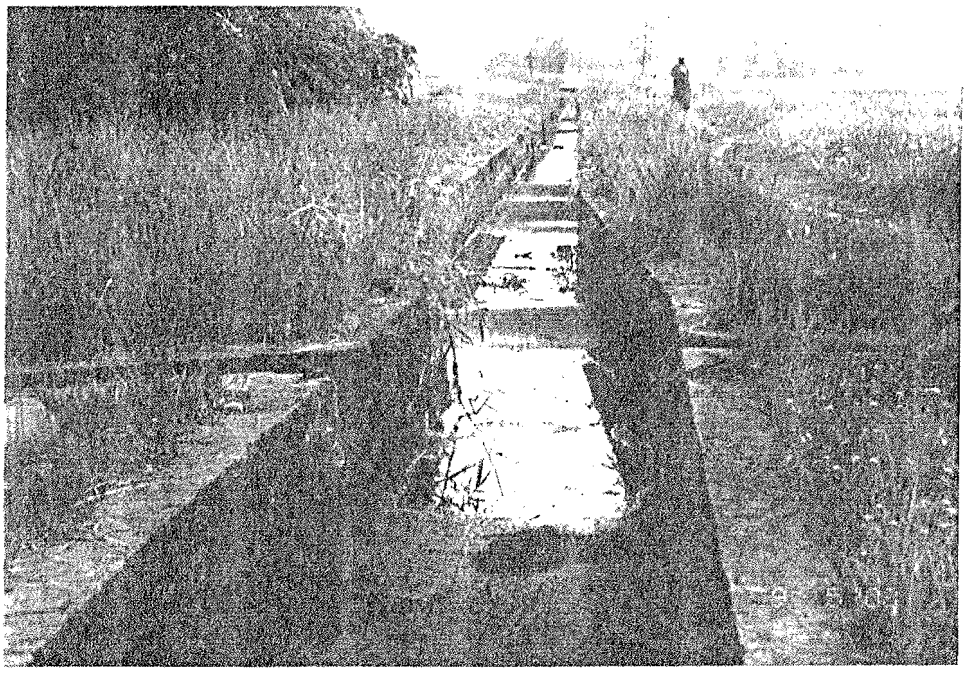


Photo – 15: Lined section with outlets (without control Structure) branch - 1
Khageri Irrigation System

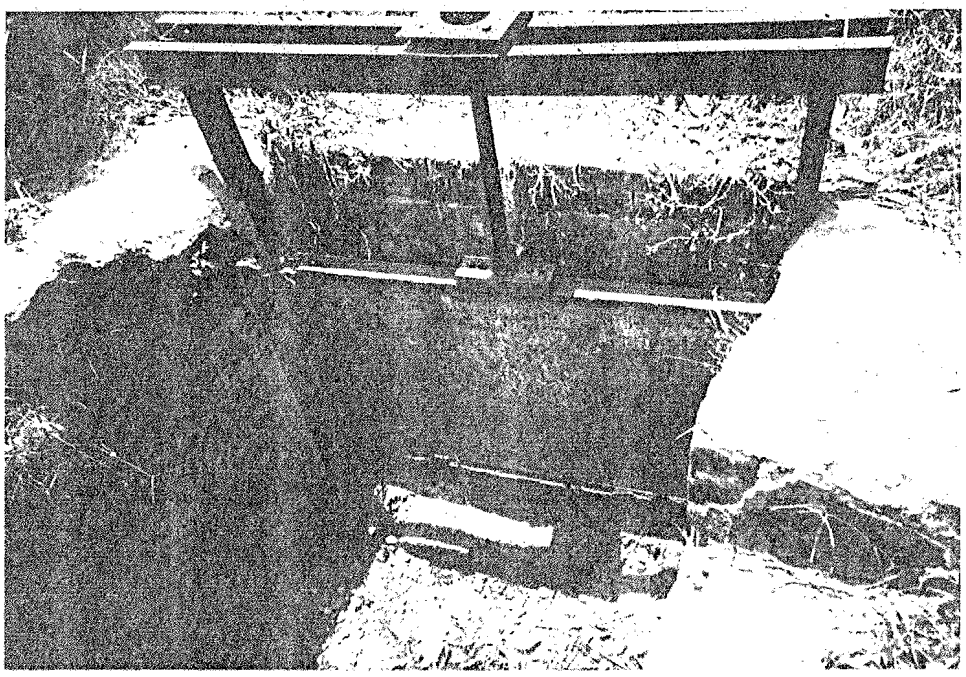


Photo – 16: Check structure of branch – 1
Khageri Irrigation System

Photo – 17: Lined and unlined section of branch - 4
Khageri Irrigation System

Photo – 18: WUA capacity assessment program by CARE/Nepal (Devnagar)
Khageri Irrigation System

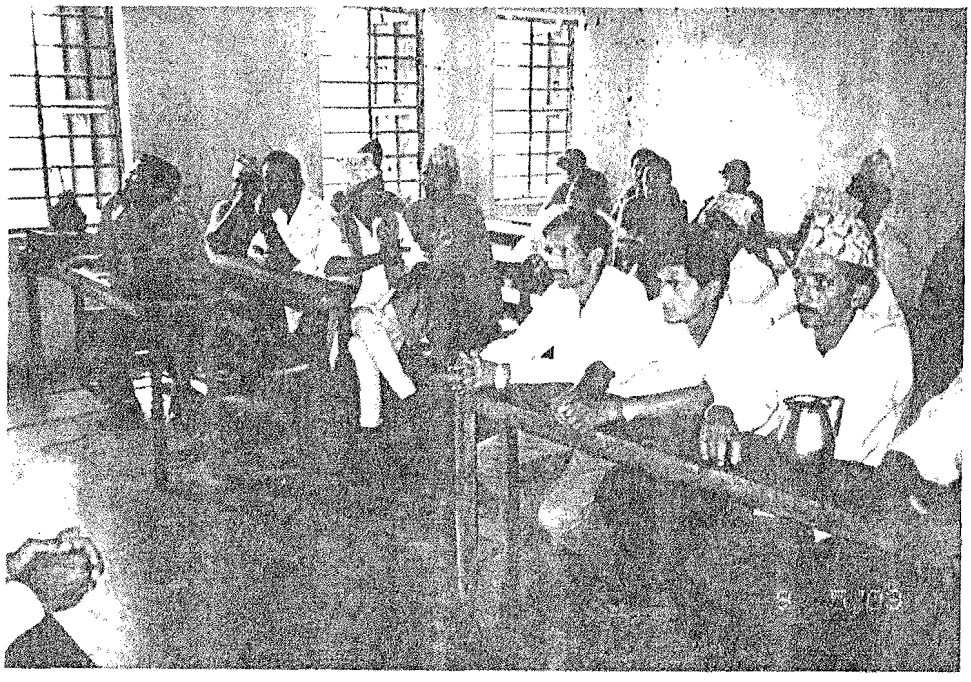


Photo – 19: Group discussion (branch – 4)
Khageri Irrigation System

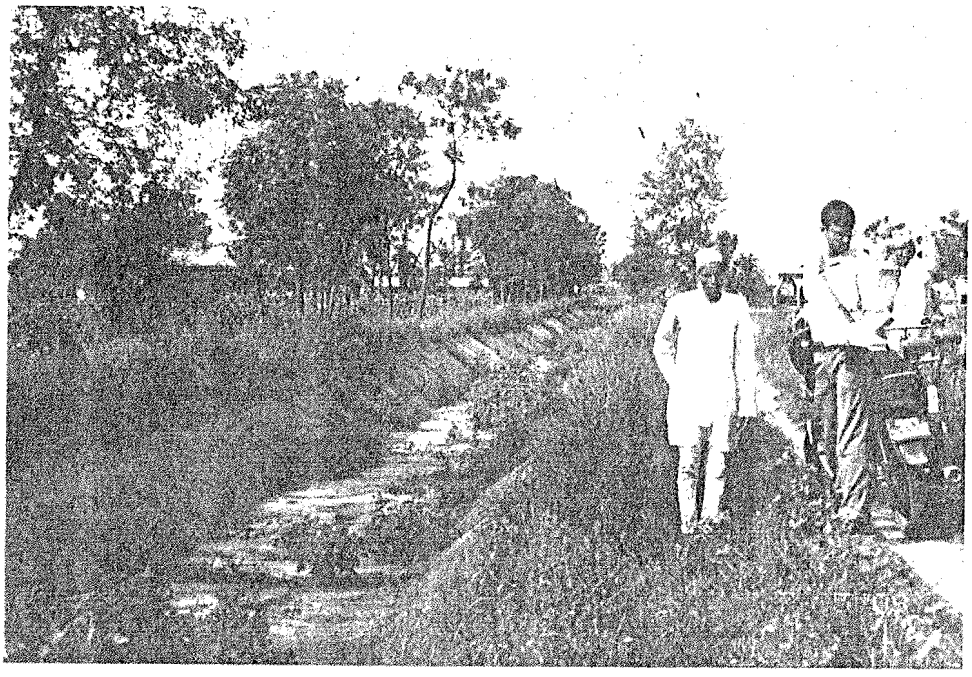


Photo – 20: Lined canal section of branch – 6 (West)
Khageri Irrigation System

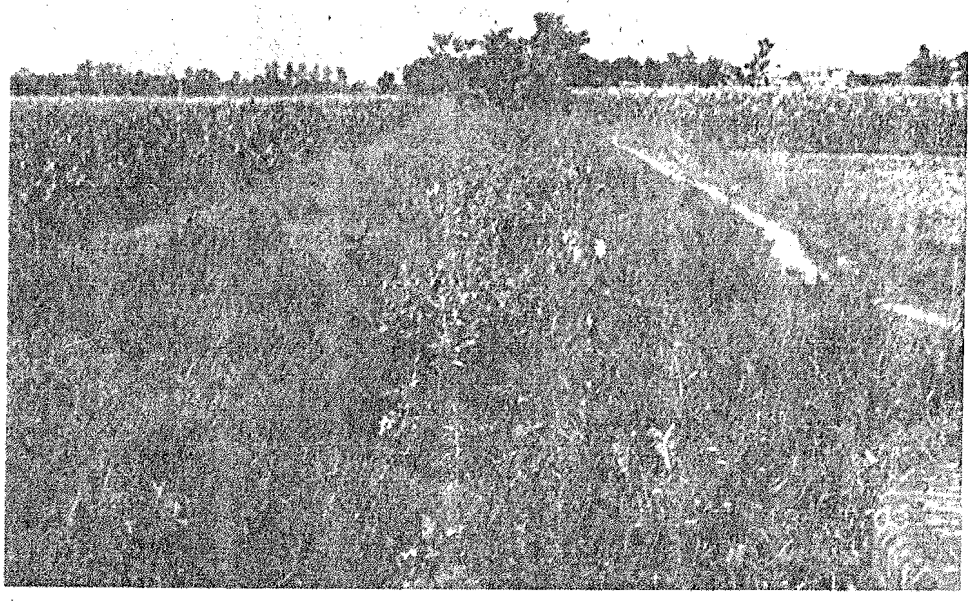


Photo – 21: Canal not cleaned and maize crop being cultivated due unavailability of water tail end of branch - 6
Khageri Irrigation System

Photo – 22: Cleaned section of lined canal (branch – 6)
Khageri Irrigation System

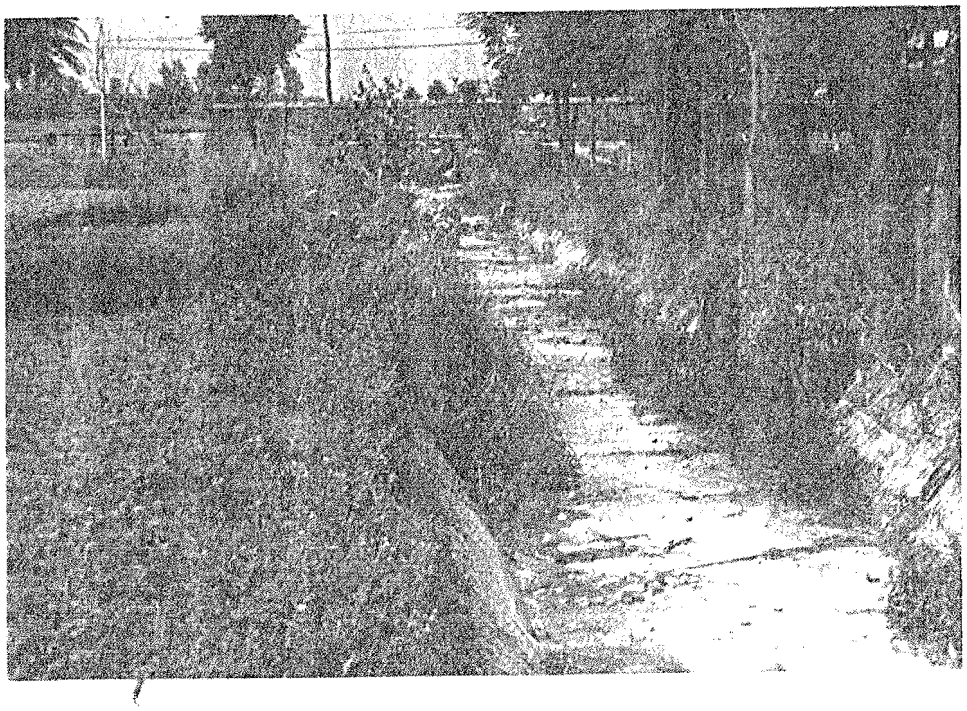


Photo – 23: Lined section of branch – 8
Khageri Irrigation System at Sharada Nagar

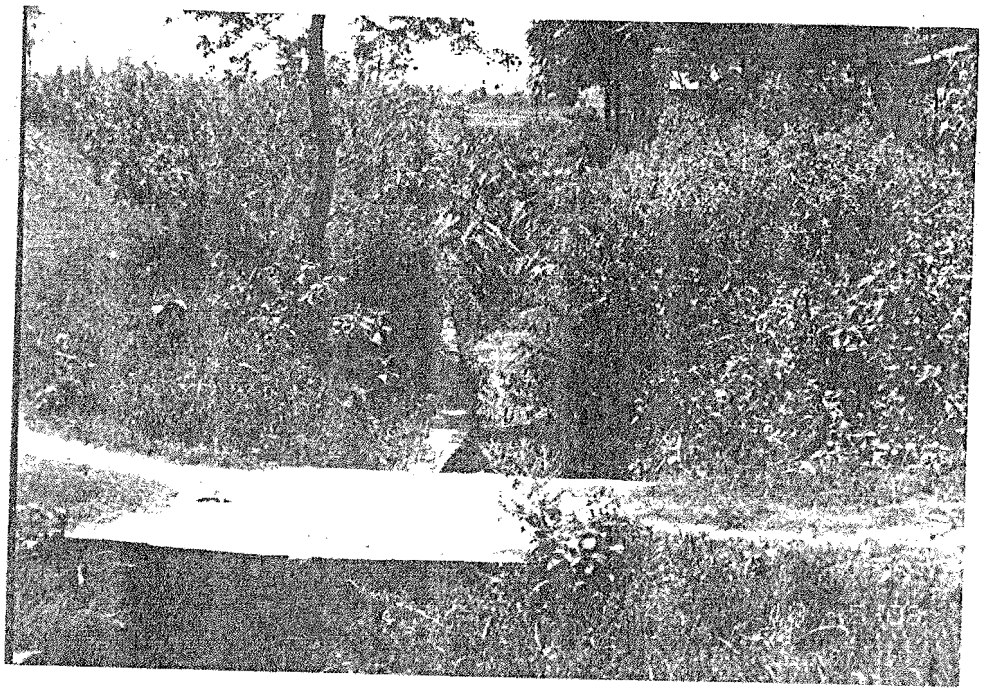


Photo – 24: Poorly maintained canal branch – 8
Khageri Irrigation System

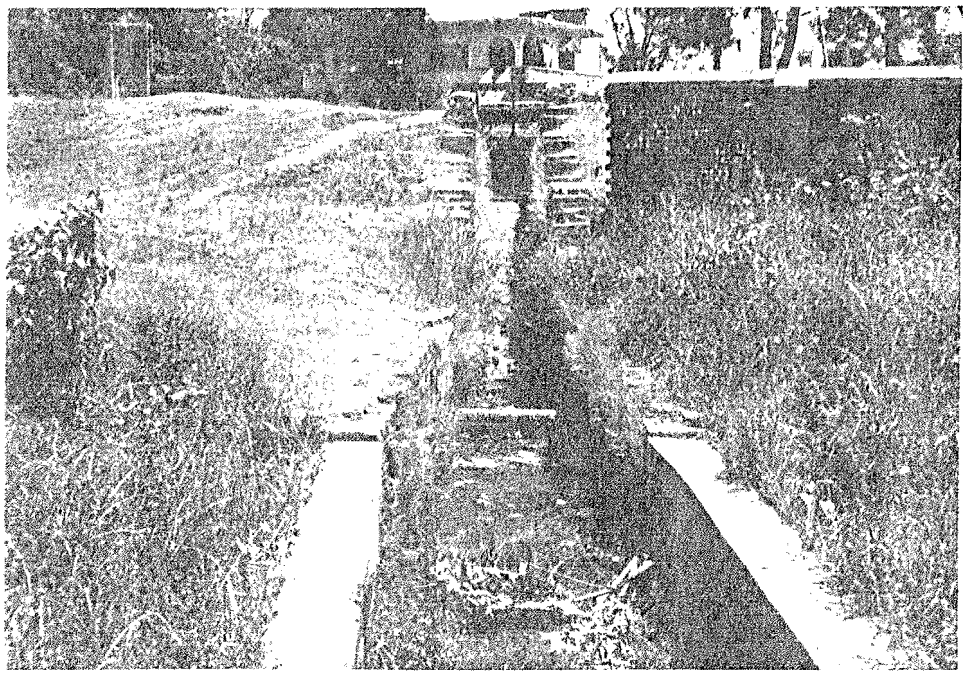


Photo – 25: Waste & garbage dumped into the canal (branch – 8)
Khageri Irrigation System

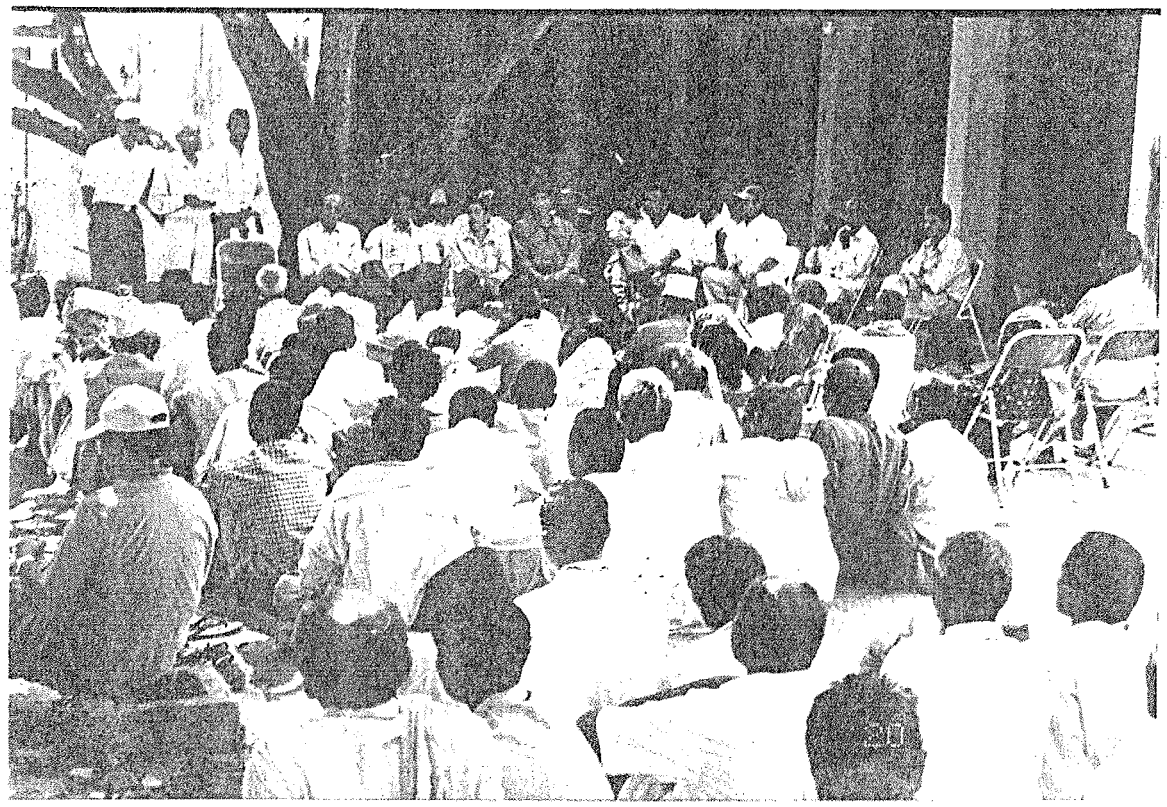


Photo – 26: GA of WUA
Nepal West Gandak Irrigation System

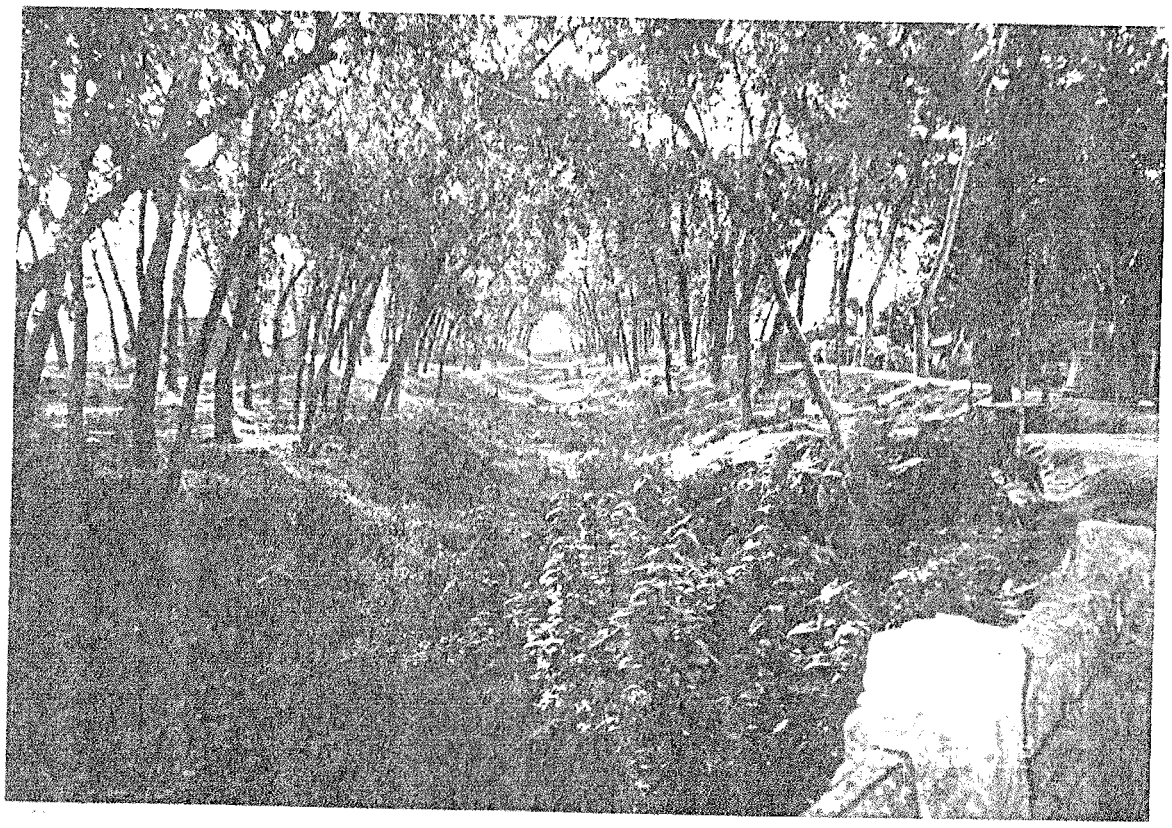


Photo – 27: Trees along the sides damaging the canal sides of the main canal (just D/S of Piparhawa branch)
Nepal West Gandak Irrigation System

Photo – 28: IMTP's construction of aqueduct at Parsauni minor
Nepal West Gandak Irrigation System

Photo – 29: Drain damaging Bishnuganj branch
Nepal West Gandak Irrigation System

Photo – 30: Canal section covered by weed at tail end of Bishnuganj Nepal West Gandak Irrigation System

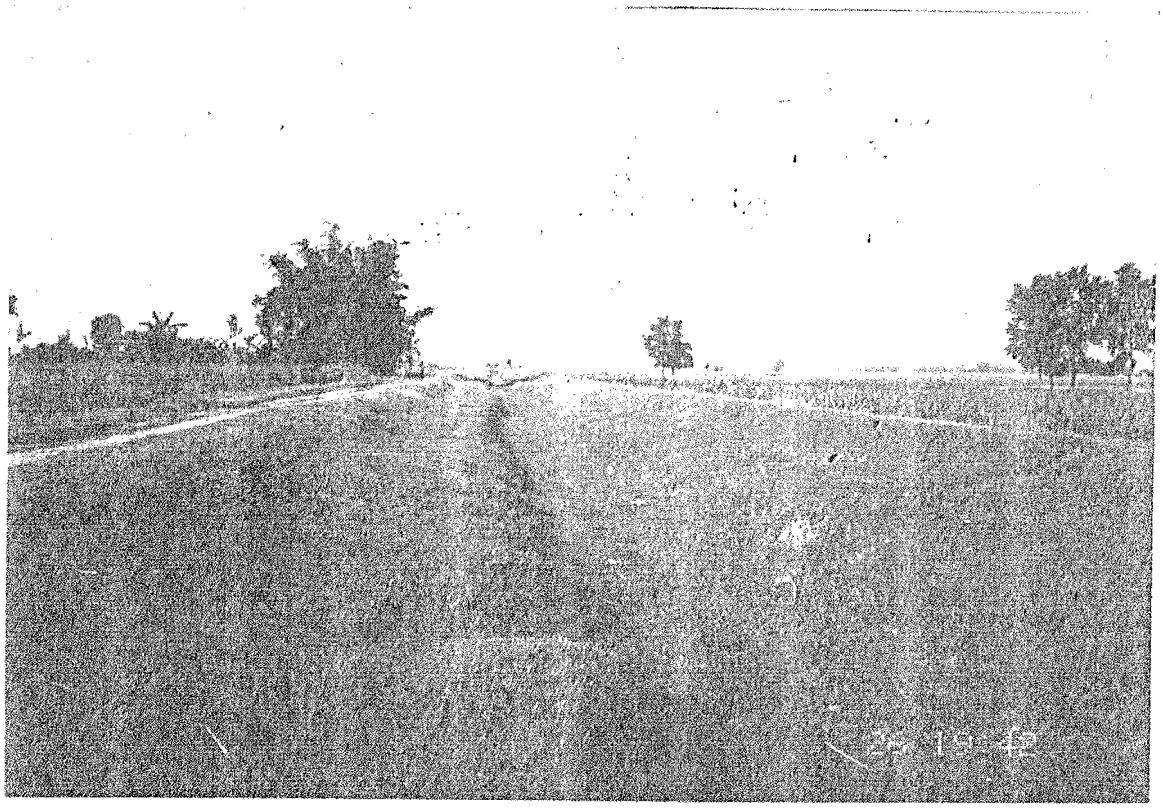


Photo – 31: Piparhawa branch Nepal West Gandak Irrigation System

Photo – 32: Group discussion with farmers from Bhujahawa branch Nepal West Gandak Irrigation System

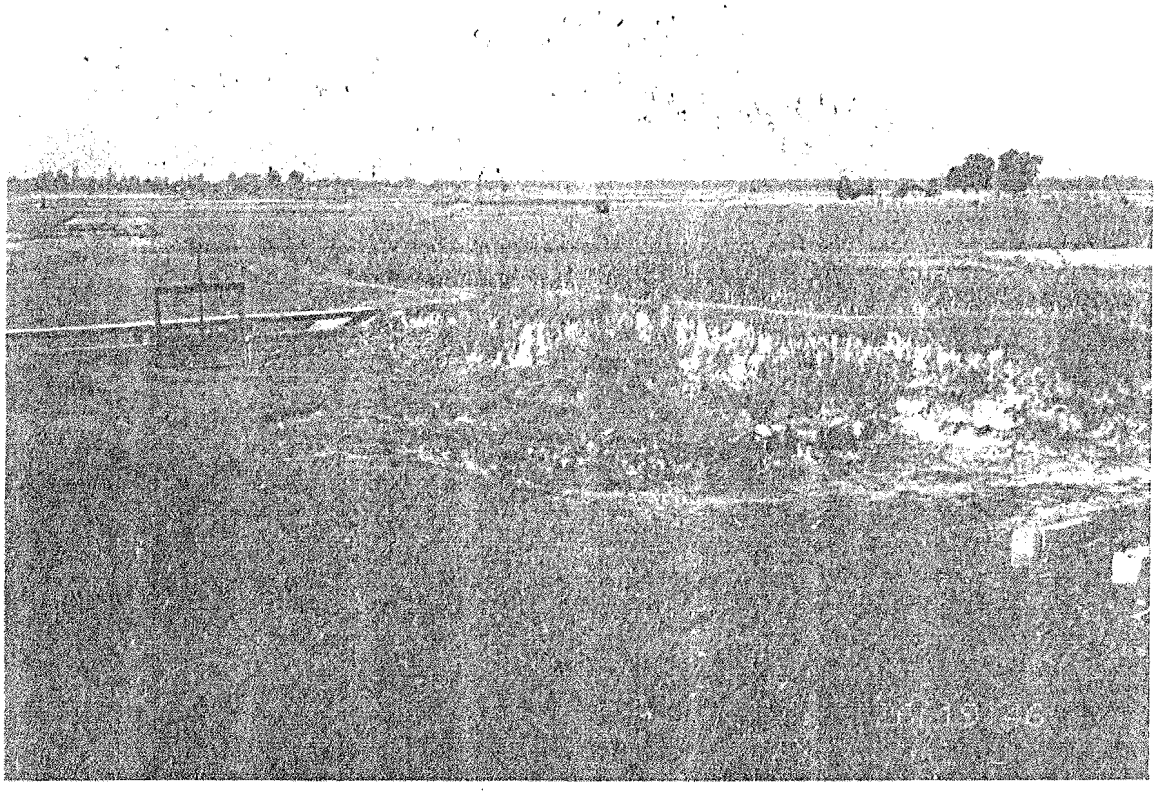


Photo – 33: Canal section almost flat Bhujahawa Nepal West Gandak Irrigation System

Photo – 34: Bhagatpurwa branch
Nepal West Gandak Irrigation System

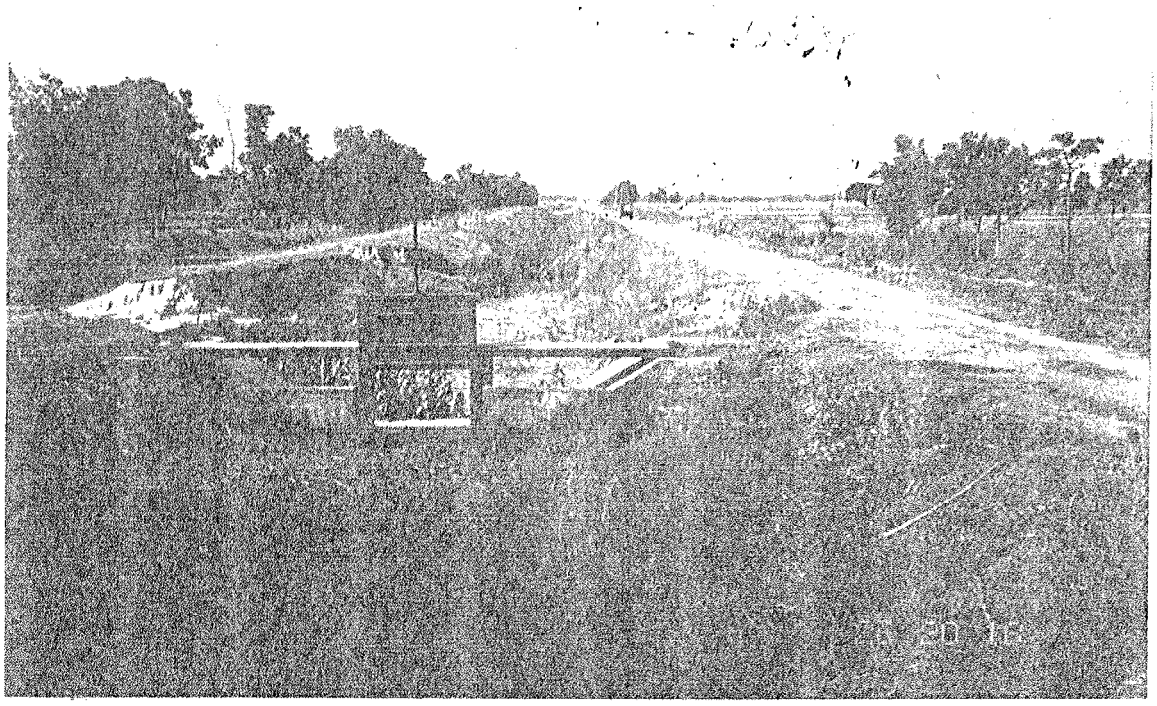


Photo – 35: Siltation in the canal at U/S of check structure and side bank damaged at D/S of the structure Bhujahawa minor
Nepal West Gandak Irrigation System

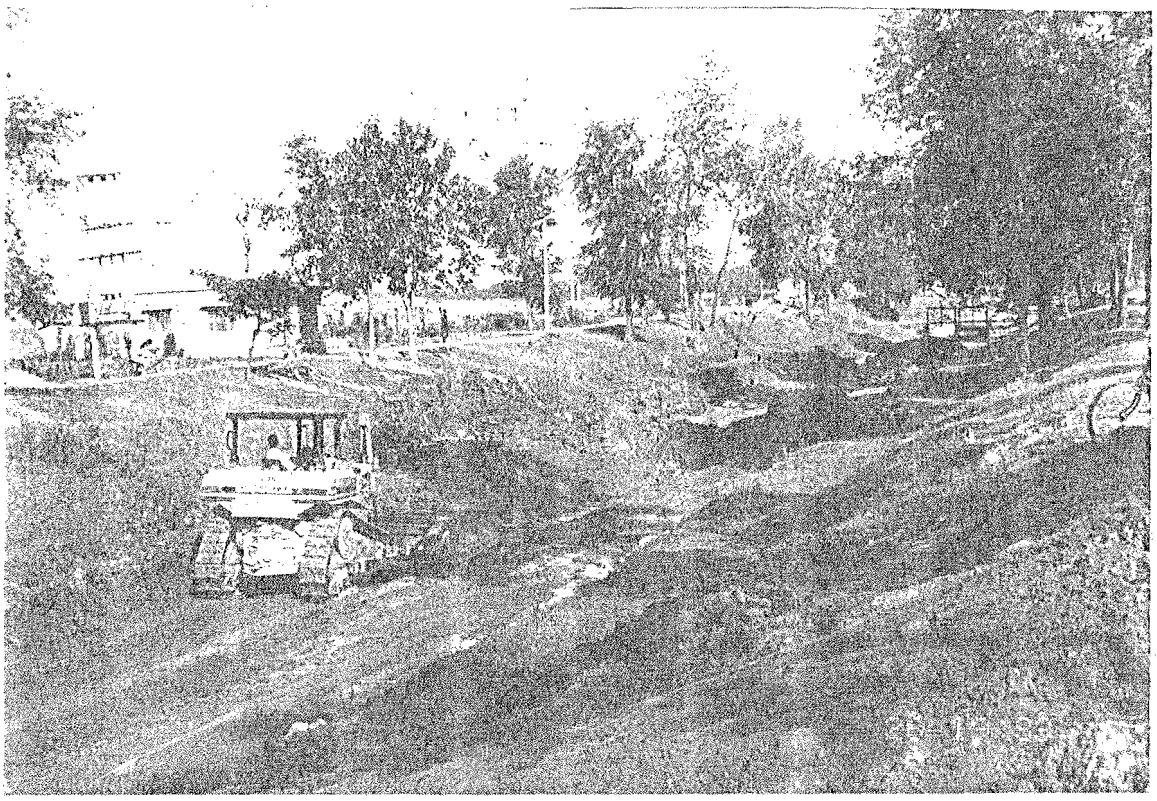


Photo – 36: Main canal desiltation
Nepal West Gandak Irrigation System

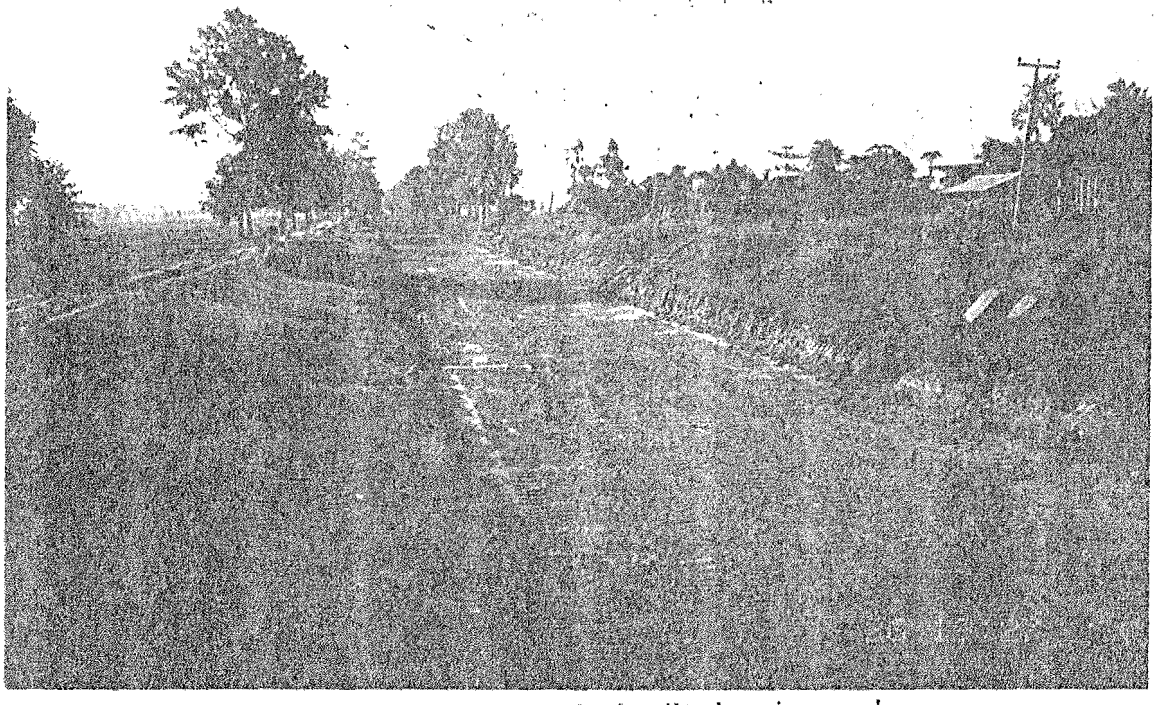


Photo – 37: Recently de-silted main canal
Nepal West Gandak Irrigation System

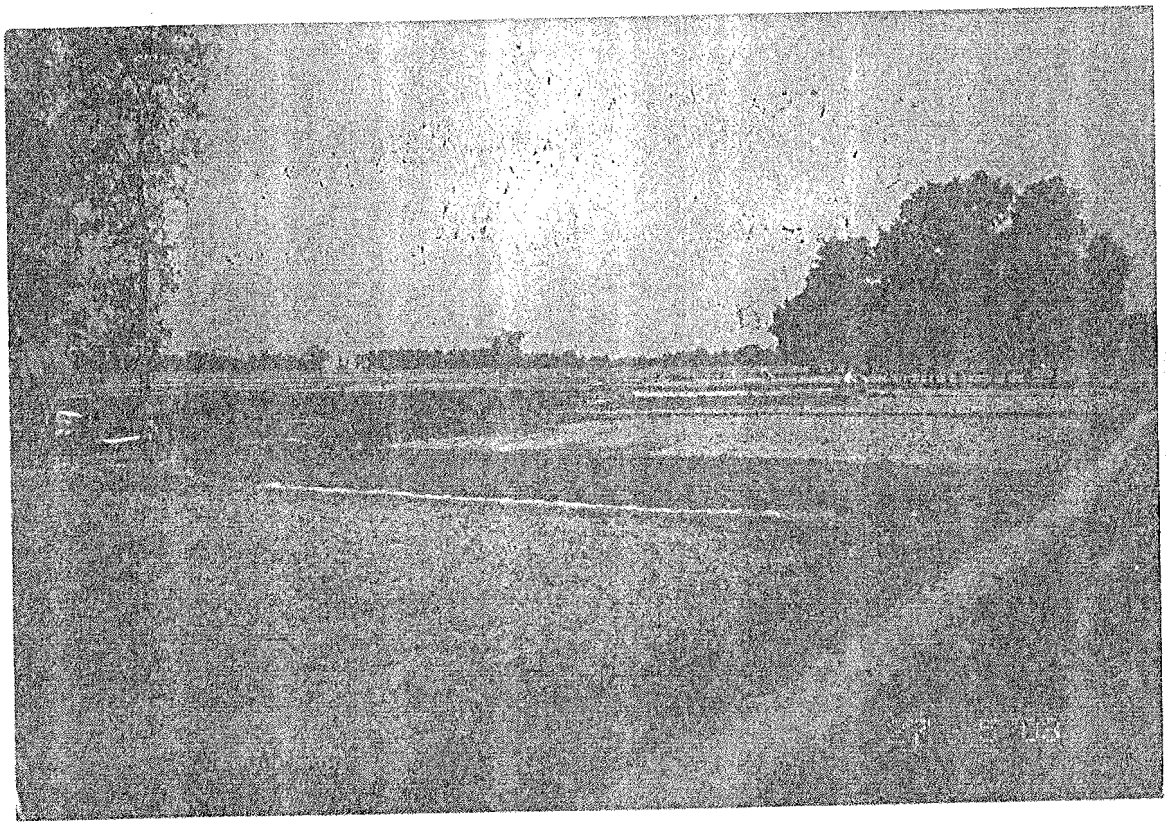


Photo – 38: Monsoon paddy plantation with pumped water Palchi minor Nepal West Gandak Irrigation System

Annex 2.5: Questionnaire used during the field study

प्रश्नावली

१) किसानको नाम:

(अन्तर्वार्ता दिने व्यक्ति):

गा.वि.स.:

वडा नं.:

शाखा प्रशाखा:

जग्गाको स्थान: (क) सिरानको जग्गा

(ख) मध्यक्रमको जग्गा

(ग) पूछारको जग्गा

२) पानीको उपलब्धता:

(क) पहिलेको तुलनामा बढि पानी उपलब्ध छ वा छैन ?

छ	छैन	छ भने के कति छ ?
☐	☐	

(ख) पानीको आपूर्ति पहिलेको भन्दा भरपर्दो छ ?

छ	छैन	सधै	धेरैजसो	कहिलेकाहि
☐	☐	☐	☐	☐

(ग) पानीको बाँडफाँड सबैलाई चित्त बुझ्ने तरिकाले हुन्छ ?

हुन्छ	हुँदैन
☐	☐

एकदमै राम्रो	ठिकै	नराम्रो
☐	☐	☐

(घ) पानी उपलब्धता तालिका (परियोजना पूर्व र अहिलेको तुलनात्मक तालिका)

बाली	क्षेत्रफल (बिघा/कठ्ठा)					
	सम्पूर्ण जग्गामा सिंचाई हुने		केही जग्गामा मात्र सिंचाई हुने		सिंचाई नहुने जग्गा	
	पहिले	अहिले	पहिले	अहिले	पहिले	अहिले
<u>गृष्म कालिन</u>						
धान						
मकै						
उखु						
तरकारी						
अन्य						
<u>शीत कालिन</u>						
गहुँ						
मकै						
आलू						
तोरी						
उखू						
तरकारी						
दलहन						
अन्य						
<u>चैते बाली</u>						
धान						
मकै						
तरकारी						
उखू						

३) बाली उत्पादन तालिका (परियोजना अगाडी र अहिलेको तुलना)

बाली	उत्पादन (क्विन्टल प्रति बिघा वा मूरी प्रति कठ्ठा)					
	सम्पूर्ण जग्गामा सिंचाई हुने		केही जग्गामा मात्र सिंचाई हुने		सिंचाई नहुने	
	पहिले	अहिले	पहिले	अहिले	पहिले	अहिले
<u>गृष्म कालिन</u>						
धान						
मकै						
उखु						
तरकारी						
<u>शीत कालिन</u>						
गहुँ						
दलहन						
मकै						
आलू						
तेलवाली						
उखू						
तरकारी						
<u>चैते बाली</u>						
धान						
मकै						
तरकारी						
उखू						

४) मलखाद प्रयोग सम्बन्धि तालिका (परियोजना अघि र पछिको तुलनात्मक)

बाली	मलखादको मात्रा (कि.ग्रा. प्रति कठ्ठा)					
	नाइट्रोजन (अमोनियम सल्फेट/यूरिया)		फस्फोरस (डाइ अमोनियम फस्फेट डि.ए.पी.)		पोटास	
	पहिले	अहिले	पहिले	अहिले	पहिले	अहिले
गृष्म कालिन						
धान						
मकै						
उखु						
तरकारी						
शीत कालिन						
गहुँ						
दलहन						
मकै						
आलू						
तेलवाली						
उखू						
तरकारी						
चैते बाली						
धान						
मकै						
तरकारी						
उखू						

गाई गोरुको माल:

५) तुलनात्मक बालिनाली विवरण (आयोजना अघि र पछिको विवरण)

बाली	आयोजना अघि लगाउने गरेको क्षेत्रफल (बिघा/कठ्ठा)	हाल लगाइने क्षेत्रफल (बिघा/कठ्ठा)	कम वा बढि लगाइने कारण
<u>गृष्म कालिन</u>			
धान			
मकै			
उखु			
तरकारी			
अन्य			
<u>शीत कालिन</u>			
गहुँ			
दलहन			
मकै			
आलू			
तेलवाली			
उखू			
तरकारी			
अन्य			
<u>चैते बाली</u>			
धान			
मकै			
तरकारी			
उखू			
अन्य			

६) उन्नत जातको बिउ बिरुवा लगाउने गरेको छ वा छैन ?

छ छैन छ भने कहाँ बाट प्राप्त भएको

छ भने सो को विवरण तालिका:

क्र.सं.	बिउको विवरण	लगाउने कारण
क)		
ख)		
ग)		
घ)		

७) पछिल्लो पाँच वर्षमा कृषि औजार, जग्गा, वस्तुभाउ, आदि खरिद गरेको छ वा छैन ?

छ छैन

खरिद गरेको वा बेचेको भए सो को विवरण

क्र.सं.	खरीद/ बिक्रि गरेको सामानको विवरण	संख्या (क्षेत्रफल)	श्रोत/आम्दानी	कारण
कृषि औजार				
(क)				
(ख)				
(ग)				
जग्गा				
वस्तुभाउ				
(क)				
(ख)				
(ग)				

८) (क) विगत ५ वर्षमा ऋण सापटि लिएको छ वा छैन ?

छ ☐ छैन ☐ के को लागि ?

(ख) लिएको भए विगत ५ वर्षको तुलनामा घटि वा बढि के छ ?

घटि ☐ बढि ☐

(ग) नलिएको भए लिन नपरेको कारण

क्र.सं.	ऋण लिन नपर्ने कारणहरु
क)	
ख)	
(ग)	

९) पहिलेको तुलनामा नहर तथा अन्य संरचनाहरुको मर्मत संभार को स्थिति के छ ?

(क) ज्यादै राम्रो

(ख) राम्रो

(ग) ठिकै

(घ) खराब

तपाईको विचारमा उपभोक्तालाई हस्तान्तरण गरेपछि नहर मर्मत संभार रेखदेख आदिको गुणस्तर हस्तान्तरण गर्नु पूर्वको तुलनामा राम्रो भएको छ वा छैन ?

छ ☐ छैन ☐ धेरै राम्रो ☐ ठिकै ☐ नराम्रो ☐

१०) उपभोक्ता किसानहरु सिंचाई व्यवस्थापन प्रणालीको वारेमा नहरको हस्तान्तरण गर्नु पूर्व भन्दा बढि सजग भएका छन वा छैनन् ।

छन ☐ छैनन् ☐ सवै जसो ☐ अधिकांश ☐ केहिमात्र ☐

११) पानी वितरणलाई लिएर हुने गरेको झैं झगडा कम भएको छ वा बढेको छ ?

कम भएको छ	बढेको छ	धेरै	ठिकै	न्यून
☐	☐	☐	☐	☐

१२) तपाईको विचारमा पानी वितरण सम्बन्धि झैं झगडा पहिलेको तुलनामा उपभोक्त समितिले नै बढि साम्य पार्न सफल भएको छ वा छैन ?

छ	छैन	धेरै	ठिकै
☐	☐	☐	☐

१३) सिंचाई प्रणालीको मर्मत सम्भारमा उपभोक्ताहरु तत्परताका साथ रकम दिई सहयोग गर्न तयार हुन्छन् वा हुँदैनन् ?

हुन्छन	हुँदैनन्	सबै	धेरैजसो	केहि
☐	☐	☐	☐	☐

१४) (क) कृषि क्षेत्र संग सम्बन्धित सरकारी तथा गैरसरकारी संघ संस्थाहरुले प्रदानगर्ने सेवामा परिवर्तन भएको छ वा छैन ?

छ	छैन	कस्तो परिवर्तन भएको छ ?
☐	☐	

(ख) भएको भए सरकारी गैरसरकारी संघ संस्थाहरु मध्ये कस्को सेवाबाट बढि सन्तुष्ट हुनु हुन्छ ?

सरकारी	गैरसरकारी	दुवै क्षेत्रबाट सहयोग नपाएको
☐	☐	☐

१५) कृषि उपज विक्रि वितरण गर्ने बजार तथा त्यसमा हुने गरेको विक्रि वितरणको तौर तरिकामा परिवर्तन भएको छ वा छैन ?

छ	छैन	उस्तै रहेको
☐	☐	☐

परिवर्तन भएको भए कस्तो परिवर्तन भएको हो ?

(क) कृषि बजारमा व्यापक विस्तार भई सर्वसूलभ भएको छ ।

(ख) विक्रि वितरणगर्न किसानलाई कठिनाई पर्ने गरेको छ ?

१६) सिंचाई नहर संग सम्बन्धित व्यक्तिहरु ऋाफ्नो काममा पहिलेको तुलनामा बढि ब्यस्त हुन थालेका छन वा छैनन् ।

छन ☐ छैनन् ☐

१७) तपाईले सिंचाई व्यवस्थापन तथा सहभागीता सम्वन्धि तालिम लिनु भएको छ वा छैन ?

छ ☐ छैन ☐ के कस्तो तालिम ?

तपाईलाई यस सम्वन्धि अझ वढि तालिम र सिपको आवश्यकता भएको लाग्छ वा प्राप्त तालिम/जानकारी वाट तपाई सन्तुष्ट हुनुहुन्छ ?

आवश्यक छ ☐ छैन ☐ सुझावहरु:

१८) पारिवारिक आय विवरण:

क.सं.	आय श्रोतको विवरण	वार्षिक आय (रु.)	पहिलेको तुलनामा वढेको/घटेको
<u>कृषिजन्य</u>			
१)	कृषि उपजको विक्रिवाट		
२)	घरपालुवा जनावर वा सो वाट हुने उत्पादनवाट		
३)	कृषि कामदारको रुपमा		
<u>अन्य</u>			
१)	नोकरी		
२)	ज्यालादारी		
३)	पसल/व्यापार		
४)	दक्ष कामदारको रुपमा		
५)	अन्य लगानीवाट		

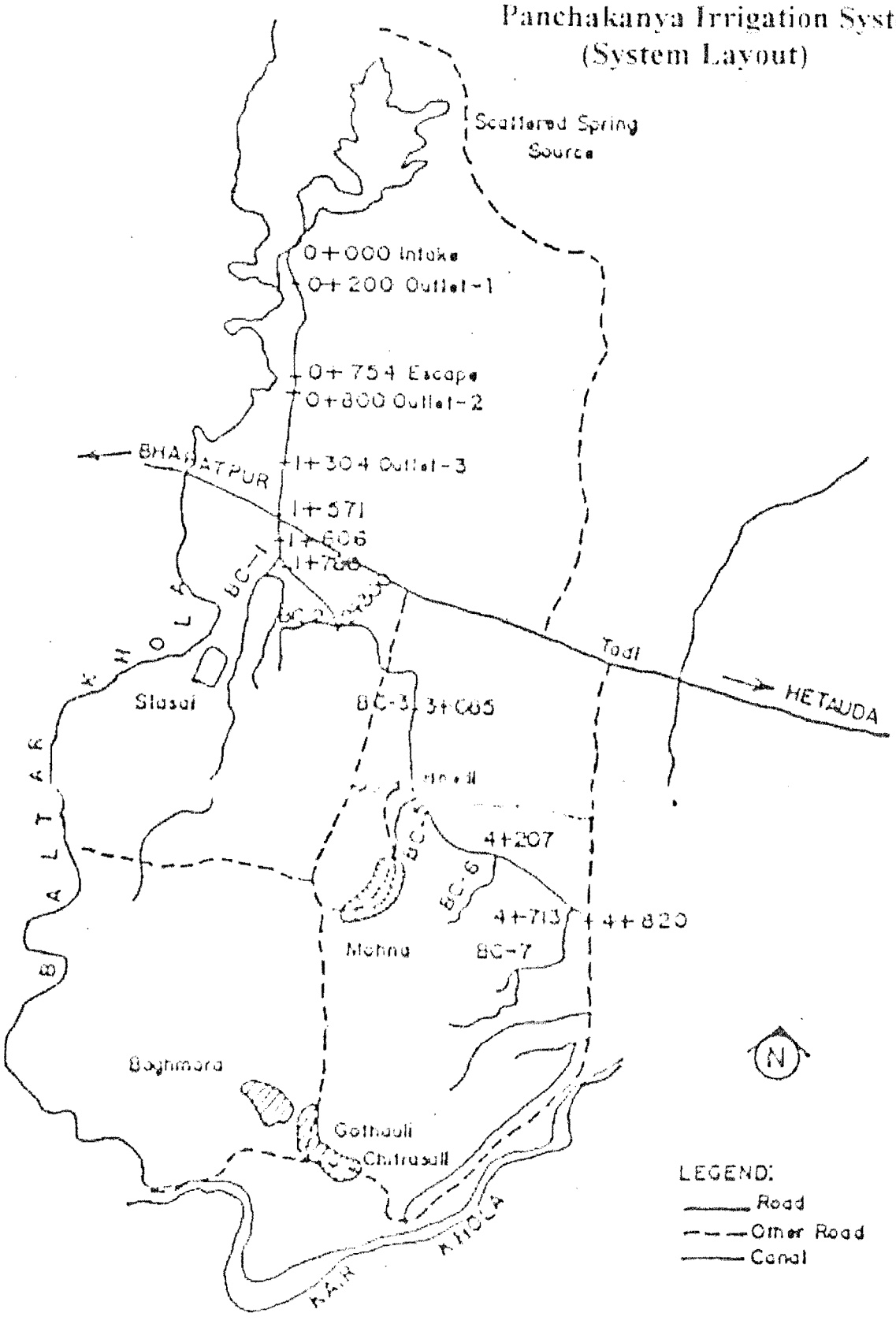
१९) आफ्नो उपभोगको लागि कृषि उपजको स्थिति के कस्तो छ ?

बालिको नाम	आफ्नो उत्पादनबाट पुग्ने	बेचेर आय हुने	किन्न पर्ने
धान			
मकै			
दलहन			
तेलहन			
तरकारी			
अन्य			

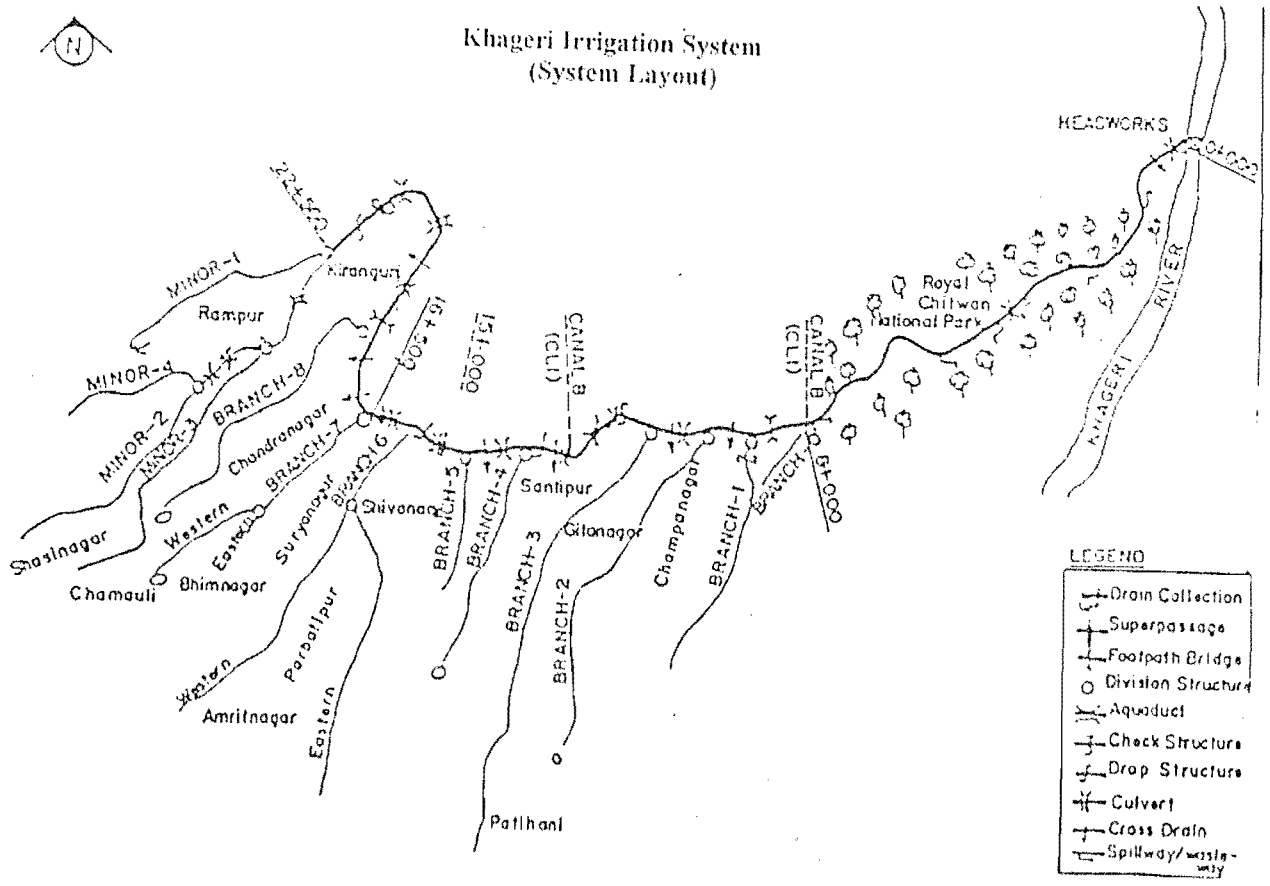
२०) अन्य

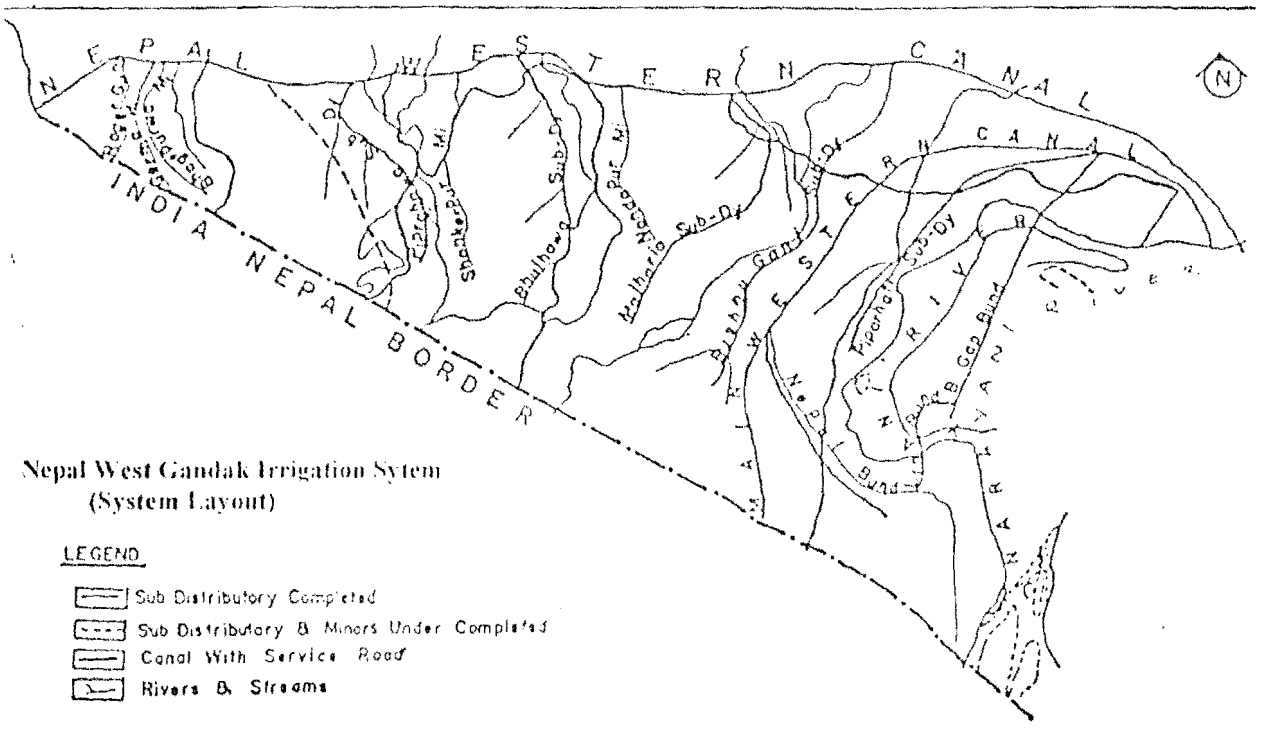
Annex – 3 (1)

Panchakanya Irrigation System
(System Layout)



Annex – 3 (2)


Khageri Irrigation System
(System Layout)
N
HEADWORKS
Royal Chitwan National Park
KHAGERI RIVER
CANAL B (CLI)
MINOR-1
Rampur
Kiranguri
MINOR-4
MINOR-2
MINOR-3
BRANCH-8
Chandranagar
BRANCH-7
Suryanagar
Shivanagar
Western
Eastern
Shashinagar
Chamauli
Bhimnagar
Amritnagar
Parsaliyur
Eastern
BRANCH-5
BRANCH-4
BRANCH-3
BRANCH-2
Santipur
Gitanagar
Patlhani
Champanagar
BRANCH-1
BRANCH-6
LEGEND
Drain Collection
Superpassage
Footpath Bridge
Division Structure
Aqueduct
Check Structure
Drop Structure
Culvert
Cross Drain
Spillway/wastage-way



Nepal West Gandak Irrigation Sytem
(System Layout)

LEGEND

- Sub Distributory Completed
- Sub Distributory & Minors Under Completed
- Canal With Service Road
- Rivers & Streams

Annex 4.1(a): Panchakanya Irrigation System

S.No.	Description	Other Details		Percentage	Remarks
1	**Farmer catagorization**		No. of farmers		
	High		10	25.64	No. of farmers
	Middle		9	23.08	No. of farmers
	Low		20	51.28	No. of farmers
2	**Land Type**	Area			
	Farm Land	26-14-10		92.16	
	Up Land	2/5/10		7.84	
	Total	30-0-0			
3	**Land Position**				
	Head			74.36	
	Middle			17.95	
	Tail			7.69	
4	**Increased water availability**				
	Monsoon			66.67	
	Winter			66.67	
	Spring				
5	**Increased reliability of supply**				
	Monsoon			84.62	
	Winter			84.62	
	Spring				
6	**Better distribution**				
	Monsoon			76.92	
	Winter			76.92	
	Spring				
8	**Incresed area of irrigated land**	Before	After		
	Complete irrigation	77-19-0	74-2-10	-5.16	
	Partial irrigation	4/4/00	4/4/00	0.00	
	No irrigation	7/6/10	6/17/00	-6.93	
9	**Increased crop productivity**	Before	After		
	Monsoon/Paddy	3564	3664	2.73	
	Winter/Pulse/Wheat	832	793	-4.92	
	Spring/Paddy/Maize	1209	1649	26.68	

10	**Increased fertilizer/manure application**	Before	After		
	N(Urea)	118	159	25.79	
	P(DAP)	79.5	104.5	23.92	
	K(Potash)	16.7	19.7	15.23	
	Cow Dung	611	611	0.00	
11	**Increased crop area**	Before	After		
	Monsoon/Paddy	40.6	39.85	-1.88	
	Winter/Pulse/Wheat	32.65	30.4	-7.40	
	Spring/Paddy/Maize	32.35	26.825	-20.60	
12	**Use of improved seeds by farmers**			35.90	
	Paddy			30.77	
	Maize			2.56	
	Others			5.13	
13	**Buying or selling in last five years**				
	Purchased			74.36	
	Equipment			7.69	
	Land	5 farmers	1/6/00	12.82	Land Area
	Livestock	22 farmers		56.41	
	Sold	11 farmers		28.21	
	Equipment			0.00	
	Land	7 farmers	3/12/00	17.95	Land Area
	Livestock	4 farmers		10.26	
14	**Loans taken in last five years**	27 farmers		69.23	
	More than before IMTP	19 farmers		48.72	
	Less than before IMTP	13 farmers		33.33	
15	**Improvement in canal maintenance condition**	Opinion No.			
	Very good	1		2.56	
	Good	27		69.23	
	OK	8		20.51	
	Bad	2		5.13	

16	**Improved quality of canal maintenance, supervision**	32		82.05	
	Very good	12		30.77	
	OK	15		38.46	
	Bad	0		0.00	
17	**Improved awareness about irrigation management**	35		89.74	
	All beneficiaries	16		41.03	
	Major beneficiaries	11		28.21	
	Few beneficiaries	3		7.69	
18	**Decrease in water distribution conflict**				
	Minimized	34		87.18	
	Maximised	6		15.38	
	Maximum dispute	20		51.28	
	Some dispute	8		20.51	
	No dispute	7		17.95	
19	**Increase in dispute resolution by WUC**	35		89.74	
20	**Beneficiaries readily contributing for maintenance**	38		97.44	
21	**Improvement in agricultural services**	1		2.56	
	No improvement	38		97.44	
22	**Satisfactory performance by organizations**				
	Governmental	1		2.56	
	Non-governmental	3		7.69	
	Neither being satisfactory	35		89.74	
23	**Change in agricultural goods market or mode of marketing**				
	Yes	2		5.41	
	No	35		94.59	

23	**Change in agricultural goods market or mode of marketing**				
	Yes	2		5.41	
	No	35		94.59	
24	**Personnel associated with irrigation system more**				
	actively engaged in their respective works				
	Yes	34		87.18	
	No	5		12.82	
25	**Beneficiaries having obtained training in irrigation management**				
	Yes	9		23.08	
	No	30		76.92	
26	**Further need of trainings**				
	Needed	30		76.92	
	Not needed	8		20.51	
27	**Family Income**				
a	**Agriculture based**	(NRs.)			
	Sale of agri. Products	402800		10328.21	Average
	From livestocks	176200		4517.95	Average
	as agri. Labourer	5000		128.21	Average
b	**Others**				
	Job	679200		17415.38	Average
	Wages	99000		2538.46	Average
	Business Miscellaneous	1007000		25820.51	Average

28	Condition of food sufficiency				
a	**Paddy**				
	Self sufficient	37		94.87	
	Surplus	26		66.67	
	Deficit	2		5.13	
b	**Maize**				
	Self sufficient	36		92.31	
	Surplus	21		53.85	
	Deficit	1		2.56	
c	**Pulse**				
	Self sufficient	27		69.23	
	Surplus	12		30.77	
	Deficit	9		23.08	
d	**Oilseed**				
	Self sufficient	8		20.51	
	Surplus	1		2.56	
	Deficit	29		74.36	
e	**Vegetables**				
	Self sufficient	14		35.90	
	Surplus	5		12.82	
	Deficit	12		30.77	

4.1 (b) Khageri Irrigation System

S.No.	Description	Other Details		Percentage	Remarks	Conclusion
1	**Farmer catagorization**	Numbers				
	Large	88		41.90		
	Medium	61		29.05		
	Small	61		29.05		
2	**Land Type**	Numbers				
	Farm Land	209.215		91.34		
	Up Land	19.84		8.66		
	Total	229.055		100.00		
3	**Land Position**	Numbers				
	Head	58		27.62		
	Middle	82		39.05		
	Tail	70		33.33		
4	**Increased water availability**	Yes	no			
	Monsoon	152	57	72.38		Substantial increase
	Winter	150	60	71.43		
	Spring					
	Increased Irrigated area(Monsoon)	24.524*			*Area(Bigha)	
	Increased Irrigated area(Winter)	21.275*				
5	**Increased reliability of supply**	Yes	no			
	Monsoon	139	71	66.19		Improved reliability
	Winter	143	67	68.10		
	Spring					
6	**Better distribution**	Yes	no			
	Monsoon	165	44	78.57		Improved distribution
	Winter	166	44	79.05		
	Spring					
8	**Incresed area of irrigated land**	Before	After			
	A. Complete irrigation	257.378	256.128	-0.49		Nominal decrease
	Monsoon/Paddy	210.0025	209.0025	-0.48		
	Winter/Pulse/Wheat	4.9	4.9	0.00		
	Spring/Paddy/Maize	42.475	42.225	-0.59		

9	**Increased crop productivity**	Before	After			
	Monsoon/Paddy	32120	30760	-4.23		Nominal decrease
	Winter/Pulse/Wheat	9861	9600	-2.65		
	Spring/Paddy/Maize	15049	15013	-0.24		
10	**Increased fertilizer/manure application**	Before	After			
	N(Urea)	320.5	330	2.96		
	Monsoon/Paddy	199	206	3.52		
	Winter/Pulse/Wheat	63.5	63	-0.79		
	Spring/Paddy/maize	58	61	5.17		
	P(DAP)	142.5	144.5	1.40		Nominal increase
	Monsoon/Paddy	88.5	89.5	1.13		
	Winter/Pulse/Wheat	32.5	32.5	0.00		
	Spring/Paddy/maize	21.5	22.5	4.65		
	K(Potash)	38.15	45.15	18.35		Nominal increase
	Monsoon/Paddy	15.95	18.95	18.81		
	Winter/Pulse/Wheat	11.70	11.7	0.00		
	Spring/Paddy/maize	10.50	14.5	38.10		
	Cow Dung	68900	69300	0.58		Nominal increase
	Monsoon/Paddy	64200	64600	0.62		
	Winter/Pulse/Wheat	3500	3500	0.00		
	Spring/Paddy/maize	1200	1200	0.00		
11	**Increased crop area**	Before	After			
	Monsoon/Paddy	213.3525	212.6525	-0.33		Nominal decrease
	Winter/Pulse/Wheat	69.6025	66.8025	-4.02		
	Spring/Paddy/Maize	172.2525	169.9025	-1.36		
12	**Use of improved seeds by farmers**	Yes	No			
	Paddy	6		2.86		Increase
	Maize	8		3.81		
	Others	2		0.95		
	In general	16	194	7.62		

13	Buying or selling in last five years	Yes	No			
	In general	75*	136*	35.71	*Farmers	
	Purchased					
	Equipment	7*		3.33		
	Land	4*		1.90	0-16-0	
	Livestock	31*		14.76		
	Sold					
	Equipment	0*		0.00		
	Land	3*		1.43	1/4/00	
	Livestock	36*		17.14		
14	Loans taken in last five years	Yes	No			
	More than before IMTP	22		10.48		Trend of loan taking
	Less than before IMTP	46		21.90		decreasing
	Total	68		32.38		
				0.00		
15	Improvement in canal maintenance condition	Yes	No			
	Very good	6		2.86		Canal maintenance
	Good	90		42.86		improved
	OK	96		45.71		
	Bad	16		7.62		
				0.00		
16	Improved quality of canal maintenance, supervision	Yes	No			
	Very good	20		9.52		Canal maintenance
	OK	150		71.43		improved
	Bad	17		8.10		
17	Improved awareness about irrigation management	Yes	No			
	In general	186		88.57		Awareness improved
	All beneficiaries	49		23.33		
	Major beneficiaries	128		60.95		
	Few beneficiaries	24		11.43		

18	Decrease in water distribution conflict	Yes	No			
	Minimized	166		79.05		decrease in
	Maximised	41		19.52		conflict due to
	Maximum dispute	55		26.19		irrigation water
	Some dispute	81		38.57		
	No dispute	63		30.00		
19	Increase in dispute resolution by WUC	Yes	No			
	In General conflict resolved	153	53	72.86		
						Disputes being resolved
20	Beneficiaries readily contributing for maintenance	Yes	No			
		200	8	95.24		Contributing
21	Improvement in agricultural services	Yes	No			
	Improvement	10	199	4.76		Little improvement
22	Satisfactory performance by organizations					
	Governmental	3		1.43		Beneficiaricies not
	Non-governmental	10		4.76		satisfied with the
	Neither being satisfactory	187		89.05		performance of organizations
23	Change in agricultural goods market or mode of marketing					
	Yes	9		4.29		Little change
	No	201		95.71		
24	Personnel associated with irrigation system more					
	actively engaged in their respective works					
	Yes	121		57.62		Active
	No	87		41.43		
25	eneficiaries having obtained training in irrigation management					
	Yes	6		2.86		Trainings not
	No	204		97.14		providedd for all

26	**Further need of trainings**					
	Needed	146		69.52		Need of further
	Not needed	60		28.57		trainings
27	**Family Income**					
a	**Agriculture based**	NRs.		Average(NRs.)		
	Sale of agri. Products	1884600		8974.29		To be compared with
	From livestocks	482200		2296.19		the base line
	as agri. Labourer	10000		47.62		
	Sub Total			11318.10		
b	**Others**					
	Job	3091000		14719.05		
	Wages	48000		228.57		
	Business	845000		4023.81		
	Miscellaneous	2013000		9585.71		
	Sub Total			28557.14		
	Total			**39875.24**		
28	**Condition of food sufficiency**					
a	**Paddy**					
	Self sufficient	69		32.86		
	Surplus	115		54.76		
	Deficit	23		10.95		
b	**Maize**					
	Self sufficient	96		45.71		
	Surplus	80		38.10		
	Deficit	32		15.24		
c	**Pulse**					
	Self sufficient	98		46.67		
	Surplus	55		26.19		
	Deficit	57		27.14		
d	**Oilseed**					
	Self sufficient	9		4.29		
	Surplus	6		2.86		
	Deficit	199		94.76		
e	**Vegetables**					
	Self sufficient	73		34.76		
	Surplus	4		1.90		
	Deficit	131		62.38		
f	**Others**	0		0.00		
		4		1.90		

4.1 (c) West gandak irrigation project					
S.No.	**Description**	**Other Details**		**Percentage**	**Remarks**
1	**Farmer catagorization**		No. of farmers		
	High		141	67.79	No. of farmers
	Middle		31	14.90	No. of farmers
	Low		36	17.31	No. of farmers
2	**Land Type**	Area			
	Farm Land	527-19-16		94.62	
	Up Land	29-18-0		5.38	
	Total	557-17-16			
3	**Land Position**				
	Head		55	26.44	
	Middle		47	22.60	
	Tail		66	31.73	
4	**Increased water availability**		No.of farmer		
	Monsoon		65	51.59	
	Winter		61	48.41	
	Spring		-		
5	**Increased reliability of supply**				
	Monsoon		64	51.61	
	Winter		60	48.39	
	Spring				
6	**Better distribution**				
	Monsoon		84	53.16	
	Winter		74	46.84	
	Spring				
8	**Incresed area of irrigated land**	Before	After	% changed	
	Complete irrigation	468-5-16	424-5-0	-10.38	
	Partial irrigation	230-1-19	264-17-1	-39.58	substantial decrease
	No irrigation	83-7-0	51-19-0	-60.44	
9	**Increased crop productivity**	Before	After	% changed	
	Monsoon/Paddy	20541	19892	-3.26	
	Winter/Pulse/Wheat	11237.4	9674	-16.16	
	Spring/Paddy/Maize	390	285	-36.84	decrease

10	Increased fertilizer/manure application	Before	After	% changed	
	N(Urea)	978.2	1408.8	30.57	
	P(DAP)	948.75	1382	31.35	
	K(Potash)	60	81	25.93	Increased
	Cow Dung				
11	Increased crop area	Before	After		
	Monsoon/Paddy	337-12-6	310-3-11	-8.845741551	
	Winter/Pulse/Wheat	164-3-0	143-15-0	-14.19130435	
	Spring/Paddy/Maize	9/8/00	9/8/00	0	
12	Use of improved seeds by farmers			%	
	Paddy		80	46.78	
	Maize		44	25.73	
	Others		47	27.49	
13	Buying or selling in last five years	no of farmer	quantity	%	
	Buying /selling	70		33.65	
	Purchased				
	Equipment	58		27.88	
	Land	23	12/9/14	11.06	Land Area
	Livestock	1	1 Buffalo	0.48	
	Sold				
	Equipment	0			
	Land	2	0-2-0	0.96	Land Area
	Livestock	6	5 buffalo,1 goat	2.88	Livestock
14	Loans taken in last five years	106		50.96	
	More than before IMTP	35		16.83	
	Less than before IMTP	84		40.38	
15	Improvement in canal maintenance condition	Opinion No.			
	Very good	0		0.00	
	Good	32		15.38	
	OK	176		84.62	ok
	Bad	0		0.00	

16	**Improved quality of canal maintenance, supervision**	178		85.58	
	Very good	20		9.62	
	OK	8		3.85	
	Bad	0		0.00	
17	**Improved awareness about irrigation management**	10		4.81	
	All beneficiaries	1		0.48	
	Major beneficiaries	12		5.77	
	Few beneficiaries	51		24.52	
18	**Decrease in water distribution conflict**				
	Minimized	79		37.98	
	Maximised	101		48.56	
	Maximum dispute	2		0.96	
	Some dispute	23		11.06	
	No dispute	7		3.37	
19	**Increase in dispute resolution by WUC**	37		17.79	
20	**Beneficiaries readily contributing for maintenance**	65		31.25	
21	**Improvement in agricultural services**	19		9.13	
	No improvement	121		58.17	
22	**Satisfactory performance by organizations**				
	Governmental	65		31.25	
	Non-governmental	8		3.85	
	Neither being satisfactory	11		5.29	
23	**Change in agricultural goods market or mode of marketing**				
	Yes	69		33.17	
	No	139		66.83	

24	Personnel associated with irrigation system more				
	actively engaged in their respective works				
	Yes	40		19.23	
	No	168		80.77	
25	eneficiaries having obtained training in irrigation management				
	Yes	28		13.46	
	No	173		83.17	
26	Further need of trainings				
	Needed	109		52.40	
	Not needed	14		6.73	
27	Family Income				
a	Agriculture based	(NRs.)			
	Sale of agri. Products	4801400		23083.65	Average
	From livestocks	660200		3174.04	Average
	as agri. Labourer	286800		1378.85	Average
b	Others	(Nrs)			
	Job	1610000		7740.38	Average
	Wages	161200		775.00	Average
	Business	309700		1488.94	Average
	Miscellaneous	137700		662.02	Average
28	Condition of food sufficiency				
a	Paddy				
	Self sufficient	130		62.50	
	Surplus	33		15.87	
	Deficit	78		37.50	
b	Maize				
	Self sufficient	13		6.25	
	Surplus	0		0.00	
	Deficit	39		18.75	

c	**Pulse**				
	Self sufficient	89		42.79	
	Surplus	15		7.21	
	Deficit	116		55.77	
d	**Oilseed**				
	Self sufficient	88		42.31	
	Surplus	7		3.37	
	Deficit	114		54.81	
e	**Vegetables**				
	Self sufficient	21		10.10	
	Surplus	3		1.44	
	Deficit	114		54.81	
f	**Others**				
	Self sufficient	0		0.00	
	Surplus	21		10.10	
	Deficit	3		1.44	
	Do you no that the WUA has taken full responsibility of operation and maintenance of your canal irrigation system ?				
	yes	167		80.29	
	no	38		18.27	
				0.00	
	Are you satisfied with this kind of management operation and maintenance transfer to the WUA ?				
	Yes	36		17.31	
	No	137		65.87	
	Highly Satisfied	1		0.48	
	Satisfied	29		13.94	
	Little Satisfied	16		7.69	
	Have you completely paid the ISF and maintenance fee of the system ?				
	yes	139		66.83	
	no	65		31.25	

Annex - 4.2 (a)

!MTP Rehabilitation at Panchakanya Irrigation Subproject

S.N.	Description	Proposed in Action Plan		Accomplished Work				Accomplished Work (WUA)	
		Quantity	Amount (NRs.)	Amount (NRs.)				Quantity	Amount (NRs.)
				Quantity	ADB	DOI	Total		
1	Aqueduct/syphon, ground water development		500000.00						
2	Cross regulator maintenance		40000.00		352000.00	88000.00	440000.00		
3	Silt removing works in main and branch canal		350000.00						350000.00
4	Damaged canal and drain maintenance due to erosion and earth filling work		126260.00						370000.00
5	Calibration of flow control structures								
6	Re-vegetation works around head work		100000.00						
7	Redesign or relocation of headwork to increase water in the canal		600000.00		394813.85	98703.46	493517.31		
8	Lining work in the main and branch canal		3046000.00		3643496.00	910874.00	4554370.00		
9	Extension and re-excavation of tertiary canal and command are development		325000.00		360000.00	90000.00	450000.00		167500.00
10	Rehabilitation and improvement of drain system		150000.00						
11	Slab culvert construction		600000.00		40000.00	10000.00	50000.00		
12	Levelling, grading, gravelling and extension of canal road		200000.00						250000.00
13	Led survey		75000.00		23128.00	5782.00	28910.00		
14	Additional Development Work		100000.00		40000.00	10000.00	50000.00		
	Total		6212260.00		4853437.85	1213359.46	6066797.31		1137500.00

Annex-4.2 (b)								
IMTP Rehabilitation Works at Khageri Irrigation Subproject								
S.N.	Particulars	Action Plan Estimated Cost			Actual Completed Work			
		Amount (NRs.)			Amount (NRs.)			
		Total	DOI	WUA	ADB	DOI	Total	WUA
1	Main canal & headworks	24590000.00	17740000.00	6850000.00	4907340.20	1226835.05	6134175.25	1250000.00
2	Branch No.0	279000.00	186300.00	93000.00	234693.21	58673.30	293366.51	45954.36
3	Branch No.1	2140000.00	1658500.00	481500.00	1856207.83	464051.96	2320259.79	
4	Branch No.2	2326000.00	1791000.00	535000.00	1704873.75	426218.44	2131092.19	31779.15
5	Branch No.3	2310000.00	1755000.00	555000.00	1751248.41	437812.10	2199060.51	374170.95
6	Branch No.4	1410500.00	1070500.00	340000.00	1291258.90	322814.72	1614073.62	77815.61
7	Branch No.5	1573000.00	1228000.00	345000.00	1164430.33	291107.59	1455537.92	168756.39
8	Branch No.6 (Western)	1375000.00	1015530.00	304470.00	1567399.90	391849.98	1959249.88	15908.48
9	Branch No.6 (Eastern)	2270000.00	1730000.00	515660.00	1492324.75	373081.19	1865405.94	22190.65
10	Branch No.7	1043500.00	798500.00	245000.00	1375086.86	343771.71	1718858.57	220839.20
11	Branch No.8	1560500.00	1190500.00	371000.00	1390653.34	347663.34	1738316.68	182526.42
12	Minor No.1	1866000.00	1381000.00	485000.00	776648.86	194162.21	970811.07	205143.33
13	Minor No.2	1757000.00	1368000.00	389000.00	934162.94	233540.73	167703.67	
14	Minor No.3	1029000.00	820000.00	209000.00	965339.78	241334.95	1206674.73	
15	Minor No.4	720600.00	530600.00	190000.00	490112.18	122528.04	612640.22	7840.14
	Total	46250100.00	34263430.00	11908630.00	21901781.24	5475445.31	26387226.55	2602924.68

Annex-4.2c

System Improvement Works at Nepal West Gandak Irrigation Sub-project

S.N.	Description	Action Plan		Accomplished Work (DOI)				Accomplished Work (WUA)	
		Quantity	Amount	Quantity	ADB	DOI	Total NRs.	Quantity	Amount
1	Earth Work		15847400.82		6683811.42	1670952.85	8354764.27		2898377.17
2	Turfing		10011.6		1346870.51	336717.63	1683588.14		386.4
3	Boulder filling in gabion		5925132.6		4444174.38	1111043.6	5555217.98		
4	P.C.C.1:2:4		3106.73		52174.31	13043.58	65217.89		
	P.C.C.1:3:6		705165.69		450922.8	112730.7	563653.5		
	P.C.C.1:4:8		48255.77		3840	960	4800		
5	Brick work masonry		1783346.6		1682638.94	420659.73	2103298.67		
6	Stone masonry		106023.03		201121.18	50280.3	251401.48		
7	Plastering		151856.63		119389.99	29847.5	149237.49		
8	R.C.C.1:2:4		487987.82		670784.71	167696.18	838480.89		
9	Shuttering		57370.42		79462.88	19855.6	99318.48		
10	Dismantling brickwork		2541.52		1914.4	478.6	2393		
	P.C.C.		11100.87		128002.53	32000.63	160003.16		1293.95
	Stone masonry		6529.19						
	R.C.C.1:2:4		1694.57						
11	Hume pipe laying		12530.8						
	30 cm		13708.1						
	40 cm		63739						
	60 cm		516888.2						
	30,40,60,90,100,120		285227.2		723516.4	180879.1	904395.5		
12	Hume pipe supply		88400		185960	46490	232450		
13	Gate fitting		50000		1281300.53	320325.13	1601625.66		
14	Gate fitting		29198.4		18400	4600	23000		
15	Gravel filter		2053690.43		486586	121646.5	608232.5		
16	Boulder soling		393300		1323070.43	330767.61	1653838.04		
17	Sub grade		2332565.15		8855	2213.75	11068.75		29178.75
18	Base course		529868.15						
19	Gravel transport		98503.76		875556.26	218889.06	1094445.32		
20	Graveling				16638.2	4159.55	20797.73		28573.75
21	E/W in shallow water				22361.52	5590.38	27951.9		
22	Bedding of rod				800	200	1000		
23	Bush clearance								18664.5
	Total	0	31615143.05	0	20808152.39	5202027.98	26010180.35	0	2976474.52

Annex 4.3

WUA Training

CURRENT STATUS OF PHASE – I IMTP SUBPROJECTS

Training Activity	West Gandak	Khageri	Panchakanya
1. Management Transfer Program Introduction.			
a) Main Committee.	√	√	√
b) Branch Canals, Tolis	√	√	√
2. Basic Administration and Office Management	√	√	√
3. Share System Development.	√	√	√
4. Share System Administration.	√	√	√
5. Financial Management and Record Keeping			
a) Main Committee Executives	√	√	√
b) Main Committee Secretary & Treasurer; Branch and Toli Committee	√	√	√
6. Canal Operation and Maintenance.			
a) Main	√	√	√
b) Branch and Tolis	√	√	√
7. Construction Management and Quality Control.	√	√	√
8. Benefit Monitoring and Evaluation.	√	√	√
9. Hydraulic Operations	√	√	√
10. Agricultural Water Management	√	√	√
11. Gender Awareness Training for Women	√	√	√
12. Observation Study Tour	√	√	√

√ = Completed

Annex 4.4 (a)
Net Benefit and Production Cost
Paddy in PIS

(Unit: per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	2.89	8250	23842.5
2	By-product	mt	2	55	110
3	Gross Return	Rs			23952.5
	Input				
4	Seed	kg	67.5	16.5	1113.75
	Fertilizer				
5	Urea	kg	105	8	840
6	DAP	kg	62	14.5	899
7	Potash	kg	25	10	250
8	Insecticides/pesticide	Rs			
	Human Labour				
9	Family Labour	M/D	61	80	4880
10	Hired Labour	M/D	61	80	4880
	Animal Labour				
11	Own animal	A/D			
12	Hired animal	A/D			
13	Tractor		9	360	3240
14	Total Input Cost	Rs			16102.75
15	Net benefit	Rs			7849.75
16	Net benefit - family labor cost	Rs			2969.75

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (b)
Net Benefit and Production Cost
Lentil in PIS

(Unit: per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	0.5	20000	10000
2	By-product	mt			
3	Gross Return	Rs			10000
	Input				
4	Seed	kg	45	30	1350
	Fertilizer				
5	Urea	kg			
6	DAP	kg			
7	Potash	kg			
8	Insecticides/pesticide	Rs			
	Human Labour				
9	Family Labour	M/D	5	80	400
10	Hired Labour	M/D	50	80	4000
	Animal Labour				
11	Own animal	A/D			
12	Hired animal	A/D			
13	Tractor		2	360	720
14	Total Input Cost	Rs			6470
15	Net benefit	Rs			3530
16	Net benefit - family labor cost	Rs			3130

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (c)
Net Benefit and Production Cost
Early Paddy in PIS

(Unit: per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	3.13	8000	25040
2	By-product	mt		600	2310
3	Gross Return	Rs			27350
	Input				
4	Seed	kg	75	17	1275
	Fertilizer				
5	Urea	kg	112	8	896
6	DAP	kg	105	19	1995
7	Potash	kg	15	10	150
8	Insecticides/pesticide	Rs			
	Human Labour				
9	Family Labour	M/D	60	80	4800
10	Hired Labour	M/D	55	80	4400
	Animal Labour				
11	Own animal	A/D			
12	Hired animal	A/D			
13	Tractor			360	2880
14	Water Charge	Rs		315	315
12	Total Input Cost	Rs			16711
15	Net benefit	Rs			10639
16	Net benefit - family labor cost	Rs			5839

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (d)
Net Benefit and Production Cost
Spring Maize in PIS

(Unit: per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	1.52	11000	16720
2	By-product	mt			
3	Gross Return	Rs			16720
	Input				
4	Seed	kg	30	20	600
	Fertilizer				
5	Urea	kg	30	8	240
6	DAP	kg	30	19	570
7	Potash	kg			
8	Insecticides/pesticide	Rs			0
	Human Labour				
9	Family Labour	M/D	70	60	4200
10	Hired Labour	M/D	8	70	560
	Animal Labour				
11	Own animal	A/D			
12	Hired animal	A/D			
13	Tractor		11	360	3960
14	Total Input Cost	Rs			10130
15	Net benefit	Rs			6590
16	Net benefit - family labor cost	Rs			2390

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (e)
Net Benefit and Production Cost
Wheat in KIS

(Unit: per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	1.17	10000	11700
2	By-product	mt	0.54	300	162
3	Gross Return	Rs			11862
	Input				
4	Seed	kg	100	18	1800
	Fertilizer				
5	Urea	kg	60	8	480
6	DAP	kg	80	19	1520
7	Potash	kg	0	10	0
8	Insecticides/pesticide	Rs			0
	Human Labour				
9	Family Labour	M/D	36	60	2160
10	Hired Labour	M/D	10	80	800
	Animal Labour				
11	Own animal	A/D			
12	Hired animal	A/D			
13	Tractor		4	360	1440
14	Total Input Cost	Rs			8200
15	Net benefit	Rs			3662
16	Net benefit - family labor cost	Rs			1502

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (f)
Net Benefit and Production Cost
Paddy in KIS

(Unit: per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	2.88	9000	25920
2	By-product	mt	2.5	600	1500
3	Gross Return	Rs			27420
	Input				
4	Seed	kg	64	15	960
	Fertilizer				
5	Urea	kg	106	8	848
6	DAP	kg	42	19	798
7	Potash	kg	19	10	190
8	Insecticides/pesticide	Rs			0
	Human Labour				
9	Family Labour	M/D	55	80	4400
10	Hired Labour	M/D	36	80	2880
	Animal Labour				
11	Own animal	A/D			
12	Hired animal	A/D			
13	Tractor		9	360	3240
14	Total Input Cost	Rs			13316
15	Net benefit	Rs			14104
16	Net benefit - family labor cost	Rs			9704

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (g)
Net Benefit and Production Cost
Maize in PIS

(Unit: per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	1.12	10000	11200
2	By-product	mt		300	162
3	Gross Return	Rs			11362
	Input				
4	Seed	kg	100	18	1800
	Fertilizer				
5	Urea	kg	60	8	480
6	DAP	kg	80	20	1600
7	Potash	kg			0
8	Insecticides/pesticide	Rs			0
	Human Labour				
9	Family Labour	M/D	36	50	1800
10	Hired Labour	M/D	10	50	500
	Animal Labour				
11	Own animal	A/D			
12	Hired animal	A/D			
13	Tractor		4	360	1440
14	Total Input Cost	Rs			7620
15	Net benefit	Rs			3742
16	Net benefit - family labor cost	Rs			1942

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (h)
Net Benefit and Production Cost
Lentil in KIS

(Unit: per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	0.5	25000	12500
2	By-product	mt			
3	Gross Return	Rs			12500
	Input				
4	Seed	kg	20	30	600
	Fertilizer				
5	Urea	kg	5	8	40
6	DAP	kg			0
7	Potash	kg			
8	Insecticides/pesticide	Rs			0
	Human Labour				
9	Family Labour	M/D	40	50	2000
10	Hired Labour	M/D	20	50	1000
	Animal Labour				
11	Own animal	A/D			
12	Hired animal	A/D			
13	Tractor			360	900
14	Total Input Cost	Rs			4540
15	Net benefit	Rs			7960
16	Net benefit - family labor cost	Rs			5960

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (i)
Net Benefit and Production Cost
Early Paddy in KIS

(Unit: per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	2.9	8000	23200
2	By-product	mt	2.2	600	1320
3	Gross Return	Rs			24520
	Input				
4	Seed	kg	75	20	1500
	Fertilizer				
5	Urea	kg	95	8	760
6	DAP	kg	38	19	722
7	Potash	kg	20	10	200
8	Insecticides/pesticide	Rs		600	600
	Human Labour				
9	Family Labour	M/D	36	80	2880
10	Hired Labour	M/D	55	80	4400
	Animal Labour				
11	Own animal	A/D			
12	Hired animal	A/D			
13	Tractor		10	360	3600
	Water Charge				120
	Compost				200
14	Total Input Cost	Rs			14982
15	Net benefit	Rs			9538
16	Net benefit - family labor cost	Rs			6658

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (j)
Net Benefit and Production Cost
Maize in KIS

(Unit: per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	1.4	10000	14000
2	By-product	mt			
3	Gross Return	Rs			14000
	Input				
4	Seed	kg	40	20	800
	Fertilizer				
5	Urea	kg	50	8	400
6	DAP	kg	50	19	950
7	Potash	kg			
8	Insecticides/pesticide	Rs		600	600
	Human Labour				
9	Family Labour	M/D	35	60	2100
10	Hired Labour	M/D	15	60	900
	Animal Labour				
11	Own animal	A/D			
12	Hired animal	A/D			
13	Tractor			360	3600
14	Total Input Cost	Rs			9350
15	Net benefit	Rs			4650
16	Net benefit - family labor cost	Rs			2550

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (k)
Net Benefit and Production Cost
Paddy in NWGCIS

(Unit: Per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	2.8	8000	22400
2	By-product	mt		500	2100
3	Gross Return	Rs			24500
	Input				
4	Seed	kg	40	15	600
	Fertilizer				
5	Urea	kg	117	8	936
6	DAP	kg	117	19	2223
7	Potash	kg	38	10	380
8	Insecticides/pesticide	Rs			0
	Human Labour				
eat in	Family Labour	M/D	35	70	1750
10	Hired Labour	M/D	60	70	4200
	Animal Labour				
11	Own animal	A/D			
12	Hired animal	A/D			
13	Tractor			360	7020
14	Total Input Cost	Rs			17109
15	Net benefit	Rs			7391
16	Net benefit - family labor cost	Rs			5641

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (l)
Net Benefit and Production Cost
Wheat in NWGCIS

(Unit: per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	1.5	12000	18000
2	By-product	mt		300	216
3	Gross Return	Rs			18216
	Input				
4	Seed	kg	125	18	2250
	Fertilizer				
5	Urea	kg	150	8	1200
6	DAP	kg	75	20	1500
7	Potash	kg			0
8	Insecticides/pesticide	Rs			0
	Human Labour				
9	Family Labour	M/D	21	70	1470
10	Hired Labour	M/D	54	70	3780
	Animal Labour				
11	Own animal	A/D			
12	Hired animal	A/D			
13	Tractor		8	360	2880
14	Total Input Cost	Rs			13080
15	Net benefit	Rs			5136
16	Net benefit - family labor cost	Rs			3666

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (m)
Net Benefit and Production Cost
Lentil in NWGCIS

(Unit: Per ha)

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	0.4	22500	9000
2	By-product	mt			0
3	Gross Return	Rs			9000
	Input				
4	Seed	kg	50	30	1500
	Fertilizer				
5	Urea	kg	75	8	600
6	DAP	kg	150	19	2850
7	Potash	kg			0
8	Insecticides/pesticide	Rs			0
	Human Labour				
9	Family Labour	M/D	30	50	1500
10	Hired Labour	M/D	15	50	750
	Animal Labour				
11	Own animal	A/D			0
12	Hired animal	A/D			0
13	Tractor		3.5	200	700
14	Total Input Cost	Rs			7900
15	Net benefit	Rs			1100
16	Net benefit - family labor cost	Rs			-400

Note: M/D= Man Days, A/D = Animal Days

Annex 4.4 (n)
Net Benefit and Production Cost
Sugarcane in NWGCIS

(Unit: ton per ha

S.N.	Items	Unit	Qty	Rate (Rs)	Amount (Rs)
	Output				
1	Production	mt	30	1400	42000
2	By-product	mt			0
3	Gross Return	Rs			42000
	Input				
4	Seed	kg	45	120	5400
	Fertilizer				
5	Urea	kg	158	8	1264
6	DAP	kg	150	18	2700
7	Potash	kg	22	20	440
8	Insecticides/pesticide	Rs			0
	Human Labour				
9	Family Labour	M/D	30	70	2100
10	Hired Labour	M/D	25	70	1750
	Animal Labour				
11	Own animal	A/D			0
12	Hired animal	A/D	60	200	12000
13	Tractor		30	150	4500
14	Total Input Cost	Rs			30154
15	Net benefit	Rs			11846
16	Net benefit - family labor cost	Rs			9746

Note: M/D= Man Days, A/D = Animal Days

Annex-4.5

Hand over dates of PIS :

WUA started O&M on their own from 20 Ashad 2054
However the formal hand-over took place on 28 Mansir 2054

Hand over dates of KIS

Branch	Date of Hand-over
Branch 0 & 1	2055/3/24.
Branch 2	2055
Branch 3	2056/4/
Branch 4	2055/4/27.
Branch 5	2056/4
Branch 6 (East)	2055/3/25.
Branch 6 (West)	2055/3/28.
Branch 7	2055/2/10.
Branch 8	2055/4/26.
Minor 1	2056/3
Minor 2	2055/6/30.
Minor 3	2055/4/28.

Hand over dates of NGWCIS

Formally handed over 14 Mansir, 2054

S.N.	Name of WUA Committee/Branch	Handover date
1	MC 1	2051-3-8.
2	SFD 1	2051-3-8.
3	SFD 2	2050-3-6.
4	MC 2	2050-3-6.
5	MC 3	2051-2-9.
6	SFD 3	2051-2-9.
7	Chhiwani water course	2051-2-9.
8	MC 4	2051-2-9.
9	SFD 4	2051-2-9.
10	MC 5	2051-2-9.
11	Visnuganj Br.	2053-12-7.
12	MC 6	2051-2-9.
13	MC 7	2053-3-31.
14	MC 8	2053-3-21.
15	MC 9	2051-2-12.
16	MC 10	2051-2-12.
17	Manihariya Mnr.	2053-6-13.
18	MC 11	2051-2-16.
19	Nandapur Mnr	2051-2-9.
20	MC 12	2050-3-27.
21	Bhujahawa Br.	2052-4-9.
22	Shankapur Mnr.	2051-2-9.
23	MC 15	2051-2-9.
24	MC 16	2051-2-9.
25	MC 17	2051-2-9.
26	MC 18	2051-2-9.
27	MC 19	2051-2-9.
28	MC 20	2053-3-31.
29	Piparhawa Br.	2051-2-12.
30	SFD 5	2053-3-31.

31	MC 21	2053-3-31.
32	MC 22	2053-3-31.
33	MC 23	2053-3-31.
34	MC 24	2053-3-27.
35	Palhi Mnr.	2050-2-11.
36	Germi Mnr.	2050-3-5.
37	Bhagatpurwa Mnr.	2050-2-32.
38	Ragarganj Mnr.	2050-3-3.
39	MC 25	2050-3-3.
40	MC 26	2050-3-7.
41	SFD 6	2050-3-3.

Source: WUA records

Annex – 4.6(1) Economic Evaluation of the Investment of IMTP in PIS

Table A-4.6 (1)
Net Present Value of Incremental Benefit Calculation for Panchakanya Irrigation System

Total Net Benefit Before IMTP (NRs/year)	Total Net Benefit After IMTP (NRs/year)	Total Net Incremental Benefit After IMTP (NRs/year)
7932949	7597075	457420.9

Base Year 2000/2001		Net Present Value of Incremental Benefit in the Base Year at Different Discount Rates									
Start Year 1997/1998		Discount Rate (%)									
Year	Actual Value	2	4	6	8	10	12	14	16	18	20
1	320195	326599	333002	339406	345810	352214	358618	365022	371426	377830	384234
2	365937	380721	395797	411166	426829	442783	459031	475571	492404	509530	526949
3	457421	457421	457421	457421	457421	457421	457421	457421	457421	457421	457421
4	457421	448452	439828	431529	423538	415837	408412	401246	394328	387645	381184
5	457421	439659	422911	407103	392165	378034	364653	351971	339938	328513	317653
6	457421	431038	406646	384059	363115	343667	325583	308746	293050	278400	264711
7	457421	422586	391005	362320	336218	312425	290699	270830	252629	235933	220593
8	457421	414300	375967	341812	311313	284022	259553	237570	217784	199943	183827
9	457421	406177	361506	322464	288253	258202	231744	208395	187745	169443	153189
10	457421	398212	347602	304211	266901	234729	206914	182802	161849	143596	127658
11	457421	390404	334233	286992	247130	213390	184745	160353	139525	121691	106381
12	457421	382749	321378	270747	228824	193991	164951	140661	120280	103128	88651
13	457421	375244	309017	255421	211874	176356	147277	123386	103690	87397	73876
14	457421	367887	297132	240964	196180	160323	131498	108234	89388	74065	61563
15	457421	360673	285704	227324	181648	145748	117409	94942	77058	62767	51303
16	457421	353601	274715	214457	168193	132499	104829	83282	66430	53192	42752
17	457421	346668	264149	202318	155734	120453	93597	73055	57267	45078	35627
18	457421	339870	253990	190866	144198	109503	83569	64083	49368	38202	29689
19	457421	333206	244221	180062	133517	99548	74615	56213	42559	32375	24741
20	457421	326673	234828	169870	123627	90498	66621	49310	36689	27436	20617
21	457421	320268	225796	160255	114469	82271	59483	43254	31628	23251	17187
22	457421	313988	217111	151184	105990	74792	53110	37942	27266	19704	14318
23	457421	307831	208761	142626	98139	67993	47419	33283	23505	16698	11937
	Total	8644227	7402720	6454575	5721086	5146700	4691750	4327572	4033227	3793239	3596054

Table A-4.6 (2)
Net Present Value of Investment on Panchakanya Irrigation System

								Cost of physical improvement	Rs. 6066797	Total Investment	
								WUA Contribution	Rs. 1137500	Rs.7924727	
Base Year 2000		Net Present Value of Investment at Different Discount Rates (%)						Cost of institutional development	Rs. 720430		
Start Year 1995											
Year	Actual	2	4	6	8	10	12	14	16	18	20
1	2615160	2667463	2719766	2772069	2824373	2876676	2928979	2981282	3033585	3085889	3138192
2	2615160	2720812	2828557	2938394	3050322	3164343	3280456	3398662	3518959	3641349	3765830
3	2615160	2775229	2941699	3114697	3294348	3480778	3674111	3874474	4081992	4296791	4518996
4	0	0	0	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0
7	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	0	0	0
9	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0
15	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0
	Total NPV	8163504	8490022	8825160	9169043	9521797	9883547	10254418	10634537	11024028	11423018

Annex – 4.6(a) Economic Evaluation of the Investment of IMTP in KIS

Table A-4.6 (3)
Net Present Value of Incremental Benefit Calculation for Khageri Irrigation System

Total Net Benefit Before IMTP (NRs/year)	Total Net Benefit After IMTP (NRs/year)	Total Net Incremental Benefit After IMTP (NRs/year)
62,073,874	63,230,550	1,156,676

Base Year 2000/2001		Net Present Value of Incremental Benefit in the Base Year at Different Discount Rates									
Start Year 1997/1998		Discount Rate (%)									
Year	Actual Value	2	4	6	8	10	12	14	16	18	20
1	809,673	825,867	842,060	858,254	874,447	890,641	906,834	923,027	939,221	955,414	971,608
2	925,341	962,725	1,000,849	1,039,713	1,079,318	1,119,662	1,160,747	1,202,573	1,245,139	1,288,445	1,332,491
3	1,156,676	1,156,676	1,156,676	1,156,676	1,156,676	1,156,676	1,156,676	1,156,676	1,156,676	1,156,676	1,156,676
4	1,156,676	1,133,996	1,112,188	1,091,204	1,070,996	1,051,524	1,032,746	1,014,628	997,134	980,234	963,897
5	1,156,676	1,111,761	1,069,412	1,029,438	991,663	955,931	922,095	890,025	859,599	830,707	803,247
6	1,156,676	1,089,962	1,028,281	971,167	918,207	869,028	823,299	780,723	741,033	703,989	669,373
7	1,156,676	1,068,590	988,731	916,196	850,191	790,025	735,089	684,845	638,822	596,601	557,811
8	1,156,676	1,047,637	950,703	864,336	787,214	718,205	656,329	600,741	550,708	505,594	464,842
9	1,156,676	1,027,095	914,138	815,411	728,902	652,913	586,008	526,966	474,749	428,469	387,368
10	1,156,676	1,006,956	878,979	769,256	674,909	593,558	523,221	462,251	409,266	363,110	322,807
11	1,156,676	987,212	845,172	725,713	624,916	539,598	467,162	405,483	352,816	307,720	269,006
12	1,156,676	967,855	812,665	684,635	578,626	490,544	417,109	355,687	304,151	260,780	224,172
13	1,156,676	948,877	781,409	645,882	535,765	445,949	372,419	312,006	262,199	221,000	186,810
14	1,156,676	930,272	751,355	609,322	496,079	405,408	332,517	273,690	226,034	187,288	155,675
15	1,156,676	912,031	722,456	574,833	459,332	368,553	296,890	240,079	194,857	158,719	129,729
16	1,156,676	894,148	694,670	542,295	425,307	335,048	265,080	210,595	167,980	134,507	108,107
17	1,156,676	876,616	667,952	511,599	393,803	304,589	236,679	184,733	144,810	113,989	90,090
18	1,156,676	859,427	642,261	482,640	364,633	276,899	211,320	162,046	124,837	96,601	75,075
19	1,156,676	842,576	617,559	455,321	337,623	251,726	188,679	142,146	107,618	81,865	62,562
20	1,156,676	826,055	593,807	429,548	312,614	228,842	168,463	124,689	92,774	69,377	52,135
21	1,156,676	809,858	570,968	405,234	289,457	208,038	150,414	109,377	79,978	58,794	43,446
22	1,156,676	793,978	549,008	382,296	268,016	189,126	134,298	95,944	68,946	49,826	36,205
23	1,156,676	778,410	527,892	360,657	248,163	171,933	119,909	84,162	59,436	42,225	30,171
Total NPV		21,858,578	18,719,189	16,321,625	14,466,856	13,014,414	11,863,984	10,943,093	10,198,783	9,591,928	9,093,301

Table A- 4.6(4)

Calculation of Net Present value of IMTP Investment Khageri Irrigation System

								Cost of physical improvement	27,377,226	Total Investment		
								WUA Contribution	2,602,924	32978165		
Base Year 2000								Cost of institutional development	2,998,015			
Start Year 1995		Net Present Value of Investment at Different Discount Rates (%)										
Year	Actual value	2	4	6	8	10	12	14	16	18	20	
1	10,882,794	11,100,450	11,318,106	11,535,762	11,753,418	11,971,074	12,188,730	12,406,386	12,624,042	12,841,697	13,059,353	
2	10,882,794	11,322,459	11,770,830	12,227,908	12,693,691	13,168,181	13,651,377	14,143,280	14,643,888	15,153,203	15,671,224	
3	10,882,794	11,548,909	12,241,664	12,961,582	13,709,187	14,484,999	15,289,543	16,123,339	16,986,910	17,880,780	18,805,469	
4	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
5	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
6	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
7	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
8	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
9	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
10	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
11	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
12	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
13	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
14	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
15	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
16	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
17	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
18	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
19	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
20	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
21	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
22	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
23	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	700,000	
Total NPV		47,971,818	49,330,600	50,725,252	52,156,296	53,624,255	55,129,650	56,673,004	58,254,840	59,875,680	61,536,046	