

IMPACT OF IRRIGATION AND MINOR IRRIGATION UNDER AIBP  
IN UTTARAKHAND STATE

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## **I EXECUTIVE SUMMARY**

### **PROJECT OBJECTIVES, SCOPE AND METHODOLOGY**

The aim of the present study is to review the impact of the Government of India-sponsored Accelerated Irrigation Beneficiary Program [AIBP] in Uttarakhand State, since its inception. For the purpose of this review, the context of State plans, policies and programs for irrigation and agricultural development, including the role of Panchayat Raj Institutions is explored. The scope of the project includes a physical and financial review of AIBP as well as a review of institutional, legal, and environmental issues that are relevant to the program. The methodology consists of review of secondary data and literature and review of primary data gathered from field visits.

### **A BRIEF ON AIBP**

The Accelerated Irrigation Benefits Program (AIBP) extends financial assistance to the States for creation of irrigation potential by completion of identified ongoing irrigation projects. As per the present pattern of assistance under the AIBP, the Centre is providing grant to the irrigation projects as an incentive to the States for creating irrigation infrastructure in the country.

The AIBP was conceived in the year 1996 by the Government of India in order to provide financial assistance to States to complete various ongoing projects in the country so that envisaged irrigation potential of the project could be created and thereby extend irrigation to more areas. Since its formulation, the terms of the program have been widened and liberalized over the time.

Presently, major, medium and Extension, Renovation and Modernization (ERM) projects are eligible for Central Assistance under AIBP. The surface water minor irrigation schemes of Special Category States as well as such schemes satisfying specified criteria in Non-Special Category States are also eligible for Central Assistance under AIBP.

AIBP was started as Central Loan Assistance (CLA). From April, 2005 the Centre is providing only grant assistance to the projects under AIBP and rest of the finances are to be raised by States themselves either through Plan allocations or State resources or loans. Uttarakhand is a Special Category state. The AIBP in this State since its inception in 2000 covers Minor Irrigation as well. There are no major irrigation systems in the state. A few existing medium irrigation canals are also covered by the program.

## UTTARAKHAND - BACKGROUND

Uttarakhand State came into being in its present form with the creation of an independent State in the year 2000. It is located in the Northwestern part of the State of Uttar Pradesh in India, and is a part of the Himalayan mountain range, which separate the region from Tibet in the north; in the south lie several foothill or Terai districts of the Gangetic plains. The region encompasses an area of 46,485 km<sup>2</sup>. It measures approximately 380 kms east west and between 215-235 kms north-south length.

Administratively, the region comprises thirteen districts in Uttarakhand.

A number of sub ranges of mountains emanating from the Greater Himalayas extend into this region, as boundaries of the main river basins divide this zone into natural sub divisions. Climate being a function of the physical characteristics of a region, this region with its highly varying topographical features shows an equally variegating climatic condition, ranging from hot and sub-humid tropical in the southern tract of Bhabhar to temperate, cold alpine and glacial climates in the northern part of the high mountains. Factors such as elevation, slope aspect, proximity of glaciers, forests, mountain peaks and ridges and direction of mountain ranges together give rise to the great variations in climatic conditions, even at the micro and local levels. These factors determine the temperature range as well as the distribution of rainfall, both of which vary according to the altitude. The widely varying micro climatic conditions in the hills have a bearing on the vegetation and water resources that are to be found.

The Uttarakhand Himalayas are well drained by numerous rivers and rivulets (locally known as gad, gadhera and raula). The water resources of this region are of singular importance not only for the region but for the whole Gangetic plains of north India. The three main river systems are the Ganga basin, Yamuna Basin and the Kali System.

There has been a significant deterioration of the status of natural resources in the State. Forests are degraded to a significant extent. There has been a diminishing regulatory effect of glaciers of the Great Himalayan Zone and a long term decreasing trend of stream discharges, dwindling lakes, high surface runoff on hillsides, increase in floodwater, and decrease in base flow water in channels and rivers. Extensive soil erosion and landslips are recurring phenomena in the region. These have resulted in decrease in underground seepage which has directly contributed to the reduction of water availability in springs and streams which are the primary source of drinking water, irrigation and the running of water mills in the State.

With reference to land resources, with its fragile eco-system and geo-dynamic terrain, the state is highly vulnerable to earthquakes, landslides, forest fires, cloud bursts, etc. The state also faces serious threats from numerous man-made hazards such as massive deforestation, encroachment of unstable slopes for settlement and agriculture, ill planned and unscientifically implemented developmental schemes and projects.

## ROLE OF AGRICULTURE IN UTTARAKHAND'S ECONOMY

Agriculture is of critical importance in Uttarakhand for human sustenance, as it supports 75 – 80% of the population and forms the nucleus of most human activities in the State. Uttarakhand has a land area of 55845 km<sup>2</sup> of which 80 per cent is hilly and the remaining 20 per cent is plain land. Total cropped area accounts for around 23.5 per cent. The net area sown is around 14.5 per cent and is under pressure to sustain a population of more than 50 million, almost 80% of which is rural. Only 11 per cent of the total area is irrigated [in the hill areas], with the rest of the sown area being rain fed. The percentage of irrigated area in the plains, however, is very high, being the beneficiary of major [from erstwhile parent state Uttar Pradesh] and medium schemes.

Agriculture is described as a major component of State economy. It constitutes one third of the share of state's income. The major work force including 80 percent women workforce of the state is employed in agriculture sector. In contrast, the industrial base of the region is very weak. The major crops in the State include paddy, wheat, maize, soybean and other pulses and millets. The food grain production in the state during 1991 stood at 1487 million tones.

On the whole, 90 per cent of agriculture practiced in the state is rain fed. Farmers often grow three crops in two years. Irrigated agriculture is confined to the fertile valleys in the hills. Traditional irrigation methods in the hill area have made use of the topography of the region – the steep slopes – and have relied on gravity for watering the fields. These irrigation canals dug along the contours of the fields to maintain the flow of water are locally called *guls*. Irrigation facilities on large scale are mainly present in the outer Himalayan plains – the Duns and the Terai regions.

The farming situation in Uttarakhand is not homogeneous, but is closely related to its varied physiographical characteristics. The state has been put into zone 9 and 14 as per agro-climatic zonation followed by Central government. All these zones have different climatic conditions, slope, aspect [south facing or north facing] and height.

The farming is deeply grounded in the ecology of the region. Agriculture is seen not in isolation but in totality to include not only crops, livestock and forest but also other available natural resources including the resources held in common with others. There is wide variation among and within different eco-zones, even at short distances the micro-climate change due to interaction of various factors like elevation, altitude, soil condition, aspect etc.

Land fragmentation, dispersal of holdings and terraced farming are the characteristic features of hill agriculture. This pattern supports equity of holdings within the families. Additionally it constitutes a risk management strategy- failure of crop in one location due to micro-climatic conditions may not affect the rest of the holdings. Cropping pattern is based on indigenous knowledge and practices characterized by crop rotation and crop diversity to retain soil fertility and minimize risk. The risk balancing strategies in

agriculture are supported by creating local institutions by the rural communities for collective management of environmental resources held as common property. The practice of irrigation is an integral part of this communitarian agrarian culture.

Unlike the hills, where agriculture is subsistence oriented, in the plains, it follows a market economy, and has given impetus to ancillary industries depending on agro-products such as sugarcane mills, rice mills etc. The land holdings are far higher in the plains area. Farming is individualistic and market oriented. It is resource intensive in terms of use of water, modern agricultural technology, chemical fertilizers and pesticides and electric power. In the matter of irrigation, farmers are “consumers” of water provided by Government through the extensive canal systems and tube wells constructed by government for groups of farmers. There are also an abundance of individual wells.

The analysis of the long term trends in changes in land use in Uttarakhand reveals an overall decrease in net sown area in Uttarakhand. The decline in net sown area is linked to increase in fallow land, indicating the loss of interest in cultivation and subsequent large scale migration of agricultural male work force. The area under coarse grain, pulses and oil seeds has decreased significantly replaced by the cash crops like Sugarcane, Soybean and Potato. Much of the food grain in the state is produced in the plains where irrigated agriculture is practiced with modern farm inputs and two crops are taken in an agricultural year. The production of pulses and edible oils is insignificant in all the districts. The actual food availability in the rural areas of these districts is therefore likely to be inadequate. Since the rural poor derive about 80 per cent of their daily energy and protein requirements from cereals, the food insecurity will be high among the rural poor.

The State agriculture policy is modeled on the national agricultural policy responding to the broader trends in agricultural development elsewhere in Indian states characterized by changing market driven diversification of agriculture into non food production areas such as milk, fishery, poultry, vegetables, fruits etc. The vast and specific differences that exist in the farming situation district wise have not been taken fully into account in crafting a new agriculture policy for achieving food security in the State. As a result, there are no general or specific guidelines for the irrigation sector to likewise take into account regional differences and aim for all round development through location specific strategies.

## LEGAL FRAMEWORK IN THE IRRIGATION SECTOR IN UTTARAKHAND

The irrigation history of Uttarakhand reveals a rich social tradition and experience in the management of water for improving agricultural productivity, a tradition which the State has not kept pace with in terms of supportive policies. The irrigation policy of the State has shown a lack of appreciation and information about public participation which led to the absence of a supportive policy and legal framework that took into account this critical feature.

The new policy on water resources does identify critical elements relating to agriculture and irrigation, however, in the absence of stated policy measures and strategies in the water policy, these provisions are likely to remain on paper.

Until 1975, by the rights of communities and individuals to water sources within the boundaries of villages and private fields respectively were recognized in law. In 1975, State proprietary rights on all water sources were declared, and the customary rights of individuals and communities over water sources were abolished. This was to facilitate the provision of drinking water by State agencies to the region as a whole, which was experiencing water shortages.

Drinking water has been made a priority. Water is abstracted from any available source to supply to nearby villages. A major development has been the supply of drinking water to burgeoning urban populations from rural water sources such as rivers and streams.

The abolishment of local rights to water and the priority given to drinking water has given rise to inter-sectoral conflicts as well as reduction in water availability for irrigation.

#### STATUS OF IRRIGATION IN UTTARAKHAND.

Due to the fragmentation of the State's function in irrigation management under different departments, a totally uncoordinated system of data collection and maintenance prevails, due to which it is difficult to accurately assess the irrigation status of Uttarakhand in terms of irrigation infrastructure, and irrigated area for the State as a whole and for the different districts. From the various sources of official data, no coherent picture can be gathered on the irrigation status in the State. The different sources of data are conflicting, or are based on different parameters and therefore do not tally with each other, nor can they be compared. Subject to such inaccuracies and inconsistencies, the status of irrigation in Uttarakhand can be assessed as follows from a combination of the several sets of statistical data.

The total number of Minor Irrigation system is 80053; the total length of Canals [medium and minor] is 8328 Kms. The total State-owned surface flow and lift systems number 5776; the total non-state surface and lift flow systems number 20458; the total dug, shallow, and deep tube wells amount to 53819 [ownership data not available – predominantly non-state].

With respect to irrigated area also, there is no consistency of data emerging from the various agencies.

As per the Dept. of Economics and Statistics, the **Potential Irrigated Area under all systems [Gross] 2006-07 is 6.97 Lakh Ha;** the **Actual Irrigated Area under all systems [Gross] 2006-07 is 5.33 Lakh ha [76.4%]**. The Potential Irrigated Area [Major/Medium] 2006-07[Gross] is given as **3.720 Lakh Ha, and the Actual Irrigated Area[Major/Medium] 2006-07 [gross] as 3.220 Lakh Ha.[86%]**. **The Potential Irrigation under Minor Irrigation [State and Private] is given as 6.65 Lakh Ha and the Actual Irrigated Area as 4.96 Lakh Ha. [74%]**.

**Proportionately, area irrigated by major and medium schemes amount to 6.97 % of the total actual irrigated area and 4.6% of the Potential Irrigated Area. Actual Area irrigated by Minor Irrigation amounts to 93.02%, whereas this sector's share of Potential Irrigated Area is 95.3%. Of the latter, private minor irrigation works irrigate 53% of actual irrigated area, and 56% of Potential Irrigated Area.**

The Minor Irrigation Census 2001 does not provide data on area irrigated by various systems as per ownership, but only on their numbers [in which private systems predominate]. So it is entirely possible that private irrigation works actually irrigate a far greater proportion of the total MI command, than indicated by the data provided by the Planning department.

## REVIEW OF AIBP

The guidelines issued by the Ministry of Water Resources, Government of India on AIBP, in so far as they are applicable to Uttarakhand are that under medium schemes can be eligible for 'completion' and 'extension' of ongoing projects, or if they are 'components' of projects not receiving any other form of assistance. Since there are no incomplete major or medium projects in the state, medium schemes in the state are receiving AIBP assistance under the latter criteria. In this case, new schemes are not allowed, but only old schemes.

In the case of Minor irrigation, both old and new schemes are allowed to be included under AIBP provided that they fulfill the specified criteria of size of command area [not less than 20 Ha for individual schemes and not less than 50 Ha for groups of schemes], and specified criteria of development cost [Not more than Rs 1 Lakh per ha] and having benefit cost ratio of more than 1.

The guidelines also lay down conditions for the terms of funding, mode of disbursement and monitoring of projects.

Importantly, the only conditions in terms of reporting progress are physical [number of systems, or length of canals] and financial progress [amount received and spent]. Formation of Water Users Association for post construction maintenance is stipulated only for Minor Irrigation Schemes of Non-special category States, whereas it is critically important for both medium and minor schemes in Uttarakhand, a Special-Category State.

The types of works taken up by the Irrigation Department in Uttarakhand include Off Shoot Construction, Gul Construction, Shifting of Canals, Lining of Canals, Construction of Field Channels, Lining of Field Channels, Lining of Guls [traditional canals], Repair of Guls and Construction of Bore Cut. These include both old [mostly medium] and new [mostly minor] works. 'Lining of Canals' constitutes the predominant type of work undertaken.

The Minor Irrigation Department has taken works such as Gul Construction, Hydrant Construction, Hauz Construction, and Weir Construction. These are mostly new schemes.

From an analysis of data on budgetary allocation and expenditure, it can be seen that the proportion of AIBP budget to the total irrigation budget has risen from 7.67% in 2002-03 to as high as 50.79 % in 2007-08. The AIBP budget for the minor irrigation sector is on an average, as high as 89.3%. It is significantly higher than the major/medium sector, which is entirely appropriate for a hilly state such as Uttarakhand, where MI is far more prevalent.

An important point to be noted is that the entire AIBP budget is spent only on State schemes whether medium or minor. In the State, on the other hand, private minor irrigation works constitute a dominant mode of irrigation, in spite of which, no state assistance for this sector is available under AIBP. This is even more significant considering that the AIBP itself constituted about 90% of the State Irrigation budget.

With respect to scheme wise costs, under Minor Irrigation, the only prescription under the AIBP is that the development cost of the schemes selected should be less than Rs 1 Lakh per Ha.

It is not possible to assess whether this norm has been followed or not in the implementation of AIBP in Uttarakhand, due to the lack of appropriate data.

In terms of actual expenditure versus the budget allocation, data from MI department shows that the expenditure is mostly nearly 100%, whereas from the ID, clear data is not available.

Data on physical progress shows an increase in the number of schemes annually. However, with no data on potential or actual area irrigated, a proper understanding of 'progress' cannot be made.

The Minor Irrigation Department reports a total of 15134 Water User's organizations established in the state. The department has issues a set of guidelines for the constitution and functioning of WUAs. District wise and scheme wise details of WUAs were not available at the time of the study from the MI Department.

#### *Irrigation Status from Primary Data*

Field studies reveal show that the AIBP has not yet set a new trend in irrigation management that is necessary to improve irrigation performance. A study of 14 systems in four districts shows that planning and implementation processes are still almost completely state-centred, or department-centred, with very little or no role for Water User Groups. The irrigation potential achieved was found to be low, between 10-14 % of the CCA in MI schemes. This assessment could not be made for ID schemes, as recorded system wise data on CCA or irrigation potential created was not available. The main reasons for the low performance of schemes under AIBP was that a holistic, integrated approach had not been adopted, that includes the critical aspects of source augmentation and protection, adopting a system-wise approach in rehabilitation, involving farmers in planning and management, and providing for post-construction costs in maintaining the system. With respect to the last issue, there is no rational tariff policy for the irrigation sector, with respect to government schemes that supply water to farmers. There were no mechanisms for dispute resolution. Local, block level or district level Panchayat Institutions were not involved in the program, contrary to the provisions of the Constitution which envisage a role for PRIs in irrigation management, particularly minor irrigation.

Issues of concern raised by farmers in discussions included the lack of information about schemes, lack of opportunity for involvement in planning and implementing the schemes, declining water availability, lack of financial resources for system repair and maintenance, inequitable water distribution in state schemes particularly, poor design in construction of state systems, lack of accountability of government appointed system operators, lack of uniformity in water tariffs.

#### *Impact of other sectoral policies on Irrigation.*

Policies and programs in several other developmental sectors have an adverse impact on irrigation systems, for which there is no policy or institutional remedies. These sectors include urbanization, drinking water, land acquisition, transportation [road construction] etc.

## CONCLUSION AND RECOMMENDATIONS

The study concludes that the AIBP is a very important program for the state irrigation sector. However the success of the program cannot be accurately assessed in its entirety, due to a lack of appropriate information base. Field studies show that the scheme is not being implemented very successfully. The main reason for this situation is the lack of appropriate guidelines for the scheme from the MWR, GOI.

The existing guidelines relating to eligibility of schemes to be included under the program does not suit the situation on the ground in this hill state, particularly with respect to the size of command area, and development cost per ha. There are no provisions in the scheme to benefit private sector irrigation, which is the dominant mode of irrigation both in hills and plains. Instead, all the resources of AIBP are directed towards state –constructed and /or controlled schemes. There is no holistic, integrated natural resources management approach in a state where there are significant levels of degradation of natural resources, which threaten water availability. There is a lack of participatory approach, as the guidelines do not mandate this for all schemes. The guidelines for monitoring and evaluation of the scheme are entirely inadequate.

The AIBP is further weakened by the lack of an irrigation policy in the state.

The recommendations that emerge from the study are:-

- The State should be allowed to develop its own operational guidelines for AIBP, with some broad principles laid down in the Central Guidelines.
- Enactment of an appropriate policy for the irrigation sector as a whole in the state.
- Integrated approach to agriculture and irrigation to be adopted.
- Ensuring environmental sustainability through integrated resource management approach. A major segment of AIBP should be utilized for developing and conserving water and land resources through a watershed approach.
- Distinct program objectives and strategies for AIBP and for the irrigation and agriculture sector independently for the hill and Terai regions.
- The AIBP should include a component for establishing a Management Information System. The data base on irrigation sector should be comprehensive, including all relevant parameters.

- Irrigation planning should be linked to achieving food security, with a district based approach.
- Promotion of appropriate institutional frameworks for participatory irrigation management in state systems, including PRIs.
- An appropriate fiscal policy for the sector.
- A comprehensive review of the impact of other sectoral developments on irrigation resources and appropriate compensatory policies and strategies adopted to protect such resources.

## II THE STUDY – OBJECTIVES, SCOPE AND METHODOLOGY

**2.1 The aim of the present study** is to review the impact of the Government of India-sponsored Accelerated Irrigation Beneficiary Program [AIBP] in Uttarakhand State, since its inception. For the purpose of this review, the context of State plans, policies and programmes for irrigation and agricultural development, including the role of Panchayat Raj Institutions is also explored.

**2.2 The stated Objectives are: -**

1. To review State plans, policies and programmes for irrigation and agricultural development, including the role of Panchayat Raj Institutions.
2. To review, in the context of the above, the impact of AIBP in Uttarakhand State since its inception in promoting agricultural production, productivity and asset creation.

**2.3 A Brief on AIBP<sup>1</sup>**

The Accelerated Irrigation Benefits Programme (AIBP) extends financial assistance to the States for creation of irrigation potential by completion of identified ongoing irrigation projects. As per the present pattern of assistance under the AIBP, the Centre is providing grant to the irrigation projects as an incentive to the States for creating irrigation infrastructure in the country. The AIBP has to now meet the demands of the Bharat Nirman Programme under which a major thrust on irrigation is included. AIBP has also to provide assistance to the irrigation projects under the Prime Minister Package for agrarian distressed districts.

### Background of AIBP

A large number of river valley projects, both multipurpose and irrigation have spilled over from Plan to Plan mainly because of financial constraints being faced by the State Governments. As a result of this, despite a huge investment having already been made on these projects, the country is not able to derive the desired benefits. There were 171 Major, 259 Medium and 72 ERM on-going Irrigation projects in the country at various stages of construction at the end of VIII Plan (i.e. end of March,1997) with spillover cost of Rs. 75690 crores. This was a matter of grave concern for the Union Government and remedial measures for expeditious completion of some of the projects which were in advanced stage of completion became necessary.

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<sup>1</sup> This brief is based on the information provided by the Ministry of Water Resources, Government of India.

The AIBP was conceived in the year 1996 by the Government of India in order to provide financial assistance to States to complete various ongoing projects in the country so that envisaged irrigation potential of the project could be created and thereby extend irrigation to more areas. Since its formulation, the terms of the programme have been widened and liberalized over the time.

Only those projects are considered under the Programme, which have the investment clearance of the Planning Commission. The Projects which are already receiving assistance from domestic agencies such as NABARD etc. are not eligible for assistance under the Programme. However, the components of such projects which are not covered under such assistance by NABARD are considered for inclusion under the AIBP. Assistance to large projects is given for their phased completion so that benefits could start flowing early with comparatively smaller investments.

Presently, major, medium and Extension, Renovation and Modernization (ERM) projects are eligible for Central Assistance under AIBP. The surface water minor irrigation schemes of Special Category States as well as such schemes satisfying specified criteria in Non-Special Category States are also eligible for Central Assistance under AIBP.

AIBP was started as Central Loan Assistance (CLA). Initially 50% of the project outlay was provided as CLA and the balance 50% was to be met by State i.e. on 1:1 basis. Subsequently Special Category States were provided CLA on 3:1 basis whereas non-Special Category States on 2:1 basis. Later, it was decided that 30% of the CLA to non-Special Category States and 90% for Special Category States be converted into grant.

In March, 2005 in order to accelerate the provision of irrigation to drought prone areas and tribal area, the project providing irrigation benefits to such area (in consultation with Planning Commission) were extended the same facility as allowable to the Special Category States. From April, 2005 the Centre is providing only grant assistance to the projects under AIBP and rest of the finances are to be raised by States themselves either through Plan allocations or State resources or loans.

### AIBP in Uttarakhand

Uttarakhand is a Special Category state. The AIBP in this State since its inception in 2000 covers Minor Irrigation as well. There are no major irrigation systems in the state. A few existing medium irrigation canals are also covered by the programme.

## *2.4 Scope of the Study*

As a background and to provide a context, the agricultural sector in Uttarakhand is reviewed. The characteristics of hill and terai agriculture, the current extent of cultivated area and recent trends, the status of agricultural production and productivity, and the main features of the state agricultural policy are discussed.

Secondly, the status of the irrigation sector is reviewed, including irrigation infrastructure and area irrigated. Official statistics of the government on irrigation the sector is critically reviewed.

Thirdly, in the context of the above, the AIBP in Uttarakhand is reviewed. The parameters for review of AIBP in Uttarakhand are as follows –

- Planning and implementation processes. Involvement of local communities and elected bodies in implementation and management.
- Irrigation potential created and achieved.
- Water conservation, source protection.
- Efficient dispute resolution.
- Financial sustainability.

Until recent policy changes, Panchayat Institutions have had a meagre role to play in the matter of irrigation. With the implementation of the JRY scheme, Village Panchayats have been able to allocate expenditures on minor irrigation within their jurisdictional areas. Subsequent to the Constitutional Amendments on Panchayat Raj, it is to be expected that the mandate to PRIs would be increased. Of the subjects listed in the 11th Schedule to the Constitution to be brought under the purview of PRIs, is included minor irrigation. The review examines the modalities undertaken by the State Government to empower PRIs in the subject area of minor irrigation.

On the basis of this review and analysis, a set of recommendations for implementation of AIBP in Uttarakhand is presented.

### ***2.5 Methodology***

The methodology for study consists primarily of the collection of secondary and primary data, review and analysis.

*Firstly*, secondary data in the form of official statistics and official reports is analyzed. These sources have also been utilized for the analysis of the research parameters as well as to finalize the selection of locations for field studies for the collection of primary data.

*Secondly*, for primary data, a sample survey of Schemes constructed under AIBP was conducted.

The sample survey of irrigation systems under AIBP was conducted in Almora and Chamoli districts. The locations were selected randomly. The tools utilized in conducting primary data collection were mainly Focus Group Discussions with the farming communities, village representatives, functionaries of line department and political representatives at Kshetra Panchayat and Jilla Panchayat.

### **III BACKGROUND**

#### ***3.1 Physical description***

Uttarakhand State came into being in its present form with the creation of an independent State in the year 2000. Located in the Northwestern part of the State of Uttar Pradesh in India, the region of Kumaon and Garhwal of Uttarakhand State forms part of the great Himalayan mountain system, which spreads from the north-west to north-east, containing within it, wholly or partially, twelve States and Union territories of India. Geographically, Kumaon and Garhwal lies between 28°44' N and 31°26'5" N latitude and 77°33'5" and 81°1'E longitude. They are situated centrally between Nepal and Himachal Pradesh, separated from the former by the Kali River in the east, and from the latter by the Tons River in the northwest. The Himalayas separate the region from Tibet in the north; in the south lie several foothill or Terai districts of the Gangetic plains such as Saharanpur, Haridwar, Bijnor, Moradabad, Rampur, Bareilly and Pilibhit. The region encompasses an area of 46,485 km<sup>2</sup>. It measures approximately 380 kms east west and between 215-235 kms north-south length.

Administratively, the region comprises thirteen districts in Uttarakhand. Of these, three – Pithoragarh in the east and Chamoli and Uttarkashi in the northwest - touch the international boundaries with Tibet and Nepal, making the region strategically important to India.

A number of sub ranges of mountains emanating from the Greater Himalayas extend into this region, as boundaries of the main river basins divide this zone into natural sub divisions. The Garhwal region has more such ridges such as the Yamunotri group, the Gangotri group of peaks, the Nandakote range and the Dudhatoli range separating the main river drainage systems. The lesser Himalayan region in Kumaon Himalaya is more subdued accounting for more density of population. However, the mountains rise up to elevations of 3000 mts, before reaching the lower slopes of the Greater Himalayas, acting as the source region of many Lesser Himalayan rivers such as Kosi, Gagas, Gomti and tributaries of Ramganga West.

#### ***3.2 Climate***

Climate being a function of the physical characteristics of a region, this region with its highly varying topographical features shows an equally variegating climatic condition, ranging from hot and sub-humid tropical in the southern tract of Bhabhar to temperate, cold alpine and glacial climates in the northern part of the high mountains.

Factors such as elevation, slope aspect, proximity of glaciers, forests, mountain peaks and ridges and direction of mountain ranges together give rise to the great variations in climatic conditions, even at the micro and local levels. These factors determine the temperature range as well as the distribution of rainfall.

Table 1. Amount of Rainfall in different seasons.

Location	Seasonal rainfall (%)			
	Winter	Pre-monsoon	Monsoon	Post-monsoon
Interior parts	13.2	14.1	58.3	14.4
Frontal parts	8.6	10.7	71.0	9.7

The amount of rainfall is also associated with altitude. Rainfall increases with altitude upto a certain level above which precipitation again diminishes. At a height of 1270m above sea level, rainfall has been estimated to be 3.7 times higher than in neighboring levels, but at 300m it is 1/5<sup>th</sup>. Temperature variations occur at 1°F for every 100m rise in elevation. In general, the mean temperature is said to fall by 3.7°C with a rise of 1000m in altitude; in higher elevations, the fall is generally thought to be more rapid. (Singh & Singh, 1992) Here too there are variations between western and eastern Himalayas; further, rates of decrease in temperature vary between night time and day time, with increase in altitude, differing in each month of the year.

Thus the wide variations in altitude across the region as a whole, exhibit sharp variation in temperature. Slope, aspect and temperature are main factors determining the climatic conditions.

The physiographic and climatic features described above are the basis for the widely varying micro climatic conditions in the hills, which in turn have a bearing on the vegetation and water resources that are to be found.

### Drainage

The Uttarakhand Himalayas are well drained by numerous rivers and rivulets (locally known as gad, gadhera and raula). The water resources of this region are of singular importance not only for the region but for the whole Gangetic plains of north India.

There are three main river systems.

1. The Bhagirathi – Alaknanda basin – Ganga basin.
2. The Yamuna – Tons basin.
3. The Kali system.

### ***3.3 Status of Forests and Water Resources.***

There has been a significant deterioration of the status of natural resources in the State. According to the *State of Forest Report 2001*, brought out by the Forest Survey of India, the total forest cover in Uttarakhand is 23938 sq. km. While land under 'open forests' may be increasing due to afforestation efforts that under dense forests is not; in fact, forests are becoming less dense. About 5143 sq. km. of forest land is badly degraded and denuded and demands urgent attention. The reduction in density of forests is primarily the cause of soil erosion and its consequent impact on water resources. There has been a diminishing regulatory effect of glaciers of the Great Himalayan Zone and a long term decreasing trend of stream discharges. The capacities of the lakes have dwindled. Surface runoff on the hillsides has shown high increases. There has been increase in floodwater and decrease in base flow water in channels and rivers. Extensive soil erosion and landslips are recurring phenomena in the region. These have resulted in decrease in underground seepage which has directly contributed to the reduction of water availability in springs and streams which are the primary source of drinking water, irrigation and the running of water mills in the State. With reference to land resources, The State of the Environment Report for Uttarakhand states that, with its fragile eco-system and geo-dynamic terrain, the state is highly vulnerable to earthquakes, landslides, forest fires, cloud bursts, etc. The state also faces serious threats from numerous man-made hazards such as massive deforestation, encroachment of unstable slopes for settlement and agriculture, ill planned and unscientifically implemented developmental schemes and projects.

### ***3.4 Profile of Agriculture in Uttarakhand***

The total geographical area of the State is 56.71 lakh<sup>2</sup> hectares. *The data provided by the Planning Department shows an annual changes in the total geographical area, which is unusual and the reasons for which is unknown.* Of which total area, 80 per cent is hilly and the remaining 20 per cent is plain land. Forest is the most significant land use in Uttarakhand. 61% of the total geographical area of Uttarakhand is designated forest land. Of the total area, the Net Sown Area ranges from 13.37 % in 2002-03 to 13.52 % in 2004-05.

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<sup>2</sup> A lakh is equivalent to 100,000.

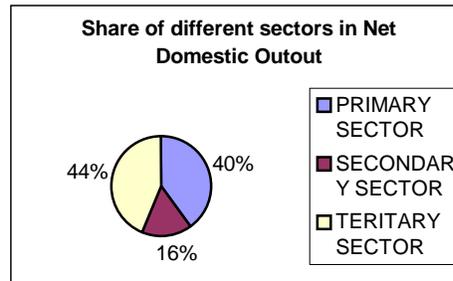
Nearly 14.81 % of the net Sown Area was lying as fallow in 2002-03 [14.95 % in 2003-04 and 14.36% in 2004-05] and about 6.81% of the total area of the state is cultivable barren land. About 8 percent of the land is under land pastures including land under trees and shrubs that is mostly in hill and is used as grazing grounds. Only 11 per cent of the total hill area is irrigated and almost 64 per cent is fed by natural springs.

Table 2. Land Use in Uttarakhand [in Ha]

S.No	Description	2002-03	2003-04	2004-05
(1)	(2)	(3)	(4)	(5)
1	Area	5671704	5668443	1994
2	Forest	3467918 [61%]	3465057 [61%]	1994 [61%]
3	Unculturable Waste	312470	311256	3988.61
4	Area under non-agricultural uses	152145	151702	3988.61
5	Culturable waste	386456	385991	7977.22
6	Permanent pastures and other grazing land	229322	228934	15954.44
7	Misc tree crops and groves	252189	251007	31908.88
8	Current fallows	41048	43090	63817.76
9	Other fallows	71367	70680	127635.52
10	NSA	758789 [13.37%]	760726 [13.42%]	255271.04 [13.52%]
11	GSA	452843	460784	467809

Source – Directorate of economics and Statistics, State Planning Department, GoUK; <http://gov.ua.nic.in>

Agriculture is described as a major component of State economy, mainly because of three reasons. One, agriculture constitutes one third of the share of state's income. Two, major work force including 80 percent women workforce of the state is employed in agriculture sector. And three, growth of overall economy depends on performance of agriculture that is a source of livelihood and food security for large majority of vast population of State.



Agriculture and allied activity accounts for 40 percent of the net domestic product of the State.

Outlay for agriculture and rural development in seventh, eighth and ninth five year plan has increased in absolute terms, but as percent of total outlay it has increased from about 33 percent to 36 percent from seventh to eighth plan, but then declined to 28 percent in ninth plan. The total plan expenditure on agriculture and allied activities in year 2001-2002 amounts to only 24 %, with the share of agriculture research at about just 6 percent. The industrial base of the region is very weak. It account for 16 percent and is mostly concentrated in the plains of Nainital and Dehradun districts. Small and household industries are, however, in large numbers spread over all the districts in the region.

The region's rural agro-pastoral economy is still predominantly subsistence-based, with about 50% of rural households, including the rural elite, having high dependence on village commons and forest lands. Although, the region had a self-sufficient economy at the time of colonial occupation (Guha, 1989), but today around 45% of the economically productive workforce is working outside the region due to lack of local employment, leaving the women to look after and manage the rural household economy.

### Cropping Pattern

The state has been put into zone 9 and 14 as per agro climatic zonation followed by Central government. It has a variety of plain and hill region. It has been further divided into four parts as per the altitude.

All these zones have different climatic conditions, slope, aspect and height, the variations extending to even short distances, where the micro-climate changes due to interaction of

these various factors. The farmer not only understands this but has adopted his farming practices accordingly over generations.

The overall cropping pattern of the Uttarakhand Himalaya is typically of an underdeveloped agricultural economy [Sati, V.P., 2005]. On the whole, 86 per cent of agriculture practiced in the state is rain fed. Here nearly 90% of the total cropped area is devoted to subsistence food crops mainly grown for domestic consumption and local market. Commercial or cash crops occupy a very negligible portion of the cropped area. Farmers often grow three crops in two years. Irrigated agriculture is confined to the fertile valleys in the hills, where HYVs and chemical fertilizers are used. Quite often, more than two crops in one year are grown.

Due to spatial differences in the agronomic, economic, and cultural conditions, variations in the cropping pattern of the region can be seen. The main crops are wheat, paddy, maize, manduwa and sanwa in food grains, urd, gram, pea, masoor, razma and gahath in pulses and mustard, soyabean, groundnut in oil seeds.

Rice and wheat dominate the agricultural realm from one corner of the region to the other. Cropping pattern also varies with the variations in the climatic conditions and cropping seasons. The influence of the monsoon on the cropping pattern is very dominant; with the result of the total cropped area about 70 to 75 per cent is under 'Kharif' or rainy season crops.

In the region whatever may be the type of soil or the amount of rainfall the dominance of food grains in the cropping pattern is everywhere obvious (Sati 1993). Table 3 reveals that the highest sown area is under wheat crop (34.79%) followed by rice with 24.3%. Mandua, a traditional millet crop has 15.1% sown area, while the area under pulses is 4.61%. Rest of the area is under other millets including koni, jhangora, jwar, bajara, maize and oilseeds. The main agricultural crops grown in the Kharif crop season in the region are rice, Mandua and sawan (both are small millets), and wheat, and barley in the Rabi crop season. Food grains such as rice, wheat, and pulses are mostly grown in valley areas and the areas with irrigation facilities. The other crops are generally grown in the high reaches where irrigation facilities are not available. Cropping patterns have not under-gone any significant changes over the past decade; the main crops have maintained their relative shares in gross cultivated area.

Table 3. Area under main crops in Uttarakhand [in ha]

S.No	Crops	2004 – 2005	2005 – 2006	2006 – 2007
(1)	(2)	(3)	(4)	(5)
1	<i>Cereal</i>	966614	959632	923842
	(a) <i>Rice</i>	299088	293097	273335
	(b) <i>Wheat</i>	393835	394805	391345
	(c) <i>Barley</i>	23802	25448	25597
	(d) <i>Corn</i>	29772	32622	29942
	(e) <i>Other crops</i>	220117	213660	203623
2	<i>Pulses</i>	44880	61190	51949
	(a) <i>Urad</i>	10921	10417	11934
	(b) <i>Matar</i>	3757	4761	3541
	(c) <i>Masoor</i>	14654	21488	13518
	(d) <i>Gram</i>	3111	765	879
	(e) <i>Other Pulses</i>	12437	23759	22077
3	<i>Oil Seeds</i>	40735	35041	28030
	(a) <i>Lahi and Mustard</i>	17030	17824	15970
	(b) <i>Groundnut</i>	2128	1550	1491
	(c) <i>Gingelli</i>	3858	2346	2065
	(d) <i>Soybean</i>	17719	13321	8504
4	<i>Other Crops</i>			
	(a) <i>Sugarcane</i>	107357	100568	120939

Source: Agriculture Directorate, Uttarakhand, 2007

The total food grain production in the State is 1791.25 MT, with the hill areas accounting for 787.90 MT and the plain areas accounting for 1003.35 MT. This is in spite of the fact that the hill area constitutes the greater portion of the geographical area, as well as a higher proportion of net sown area [57%]. The main reason is the low productivity of crops in the hill area. In comparison to the food grain productivity of 27.17 Qtl/ha in the plains, the food grain productivity in the hill area is only 12.74 Qtl/Ha

All food crops, apart from wheat and a few pulses, have undergone a decline in yields. On the margins, however, there appears to be a trend away from the production of low-value food grains towards the cultivation of high-value cash crops, as indicated by a significant decrease in the area for crops such as millets and an increase in the area under pulses (mainly soybeans).

The farming system evolved by the hill communities are based upon traditional use and practices in response to the mountain specificities. The farming is deeply grounded in the ecology of the region. Agriculture is seen not in isolation but in totality to include not only crops, livestock and forest but also other available natural resources. Owing to varying quality of cultivable land, land fragmentation is high. Fields are dispersed at different micro zones or altitudes that are equitably distributed so that each family gets its appropriate share. Terraced farming is practiced. Cropping pattern is based on indigenous knowledge and practices characterized by crop rotation and crop diversity to retain soil fertility and minimize risk. Irrigation is limited and most of the agriculture is rain fed.

Farming practices are distinct in the Terai region i.e. the plains districts, which shares the characteristics of agrarian practices of other states in the plains. In the plains, agriculture is resource intensive in terms of use of water, modern agricultural technology, chemical fertilizers and pesticides and electric power. While agriculture in the hills is subsistence oriented, in the plains, it follows a market economy, and has given impetus to ancillary industries depending on agro-products such as sugarcane mills, rice mills etc. which in turn has resulted in marketing networks (mandis), especially spread across Udham Singh Nagar<sup>3</sup>.

Irrigation facilities are mainly present in the outer Himalayan plains – the Duns and the Terai regions. Traditional irrigation methods in the hill area have made use of the topography of the region – the steep slopes – and have relied on gravity for watering the

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<sup>3</sup> “State of Environment Report for Uttaranchal”, Uttaranchal Environment Protection and Pollution Control Board, Govt of Uttaranchal, November 2004, p.128.

fields. These irrigation canals dug along the contours of the fields to maintain the flow of water are locally called *guls*.

The analysis of the data on changes in land use in Uttarakhand reveals an overall decrease in net sown area in Uttarakhand. The net sown area which meets the food grain production demands of the population constitutes only 12.42% of the reporting area. The decline in net sown area is linked to increase in fallow land, indicating the loss of interest in cultivation and subsequent large scale migration of agricultural male work force. The area under coarse grain, pulses and oil seeds has decreased significantly replaced by the cash crops like Sugarcane, Soybean and Potato. Much of the food grain in the state is produced in the plains where irrigated agriculture is practiced with modern farm inputs and two crops are taken in an agricultural year. The production of pulses and edible oils is insignificant in all the districts. The actual food availability in the rural areas of these districts is therefore likely to be inadequate. Since the rural poor derive about 80 per cent of their daily energy and protein requirements from cereals, the food insecurity will be high among the rural poor.

The State agriculture policy is modeled on the national agricultural policy responding to the broader trends in agricultural development elsewhere in Indian states characterized by changing market driven diversification of agriculture into non food production areas such as milk, fishery, poultry, vegetables, fruits etc. From the state perspective, the policy intentions are. to maximize incomes from existing resources, although it also attempts to make distinctions for the mountain and plain regions respectively but only to extent that their comparative advantages differ. The vast and specific differences that exist in the farming situation district wise have not been taken fully into account in crafting a new agriculture policy for achieving food security in the State. As a result, there are no general or specific guidelines for the irrigation sector to likewise take into account regional differences and aim for all round development through location specific strategies.

## **IV STATUS OF IRRIGATION IN UTTARAKHAND**

### ***4.1 Irrigation Systems in the Hill and Terai Regions***

The hill regions of Uttarakhand generally depend upon precipitation for agricultural crops. Rainwater and snow soak into the soil through pores and crevices, and reappear in the form of springs. These springs are either tapped directly for irrigation or the streams and rivers which they feed form the source. During the rainy season, the number and discharge of the springs increases. The supply of water in the perennial springs diminishes during winters and hot summers while it is plentiful during monsoons. In years of good rainfall, the spring water is not needed to be utilized for irrigation and is allowed to flow into streams and rivulets. Spring water could be collected in tanks and used for irrigation. However, stone and cement plastered tanks do not last as they develop cracks due to the constant changes in the earth's crust caused by the steady rise of the Himalayas, which are geologically considered to be of recent origin. Spring water can be used for irrigation at almost all altitudes. The water of springs or streams is carried through surface channels traditionally called "guls" into the fields located at lower levels. Spring water is also used for drinking purposes as it is considered hygienically good and rich in minerals<sup>4</sup>. Ponds are also used as sources for irrigation, wherever they naturally occur. Man made ponds are also prevalent in locations which permit their construction.

In addition to traditional guls, the Government has also constructed irrigation systems in the hill areas. The primary of these – canals – are based on the same principles as guls. They divert water from streams or rivers and carry water by gravity flow to fields situated downstream. In addition, Government has also introduced "surface lift" systems. These are of two types- the one worked by electricity and the other by means of a mechanism called "hydraulic ram" which lifts water by means of suction, without the use of electricity. Both these systems lift water mainly from rivers and supply to adjoining villages.

The Terai is constituted by the districts of Udham Singh Nagar, Hardwar, and parts of Nainital. Irrigation in this region is mainly from surface and ground water irrigation systems. State constructed canal systems and private and state wells – dug wells, shallow and deep tube wells- are the main types of systems.

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<sup>4</sup> Swarup. R, "Agricultural Economy of Himalayan Region, G.B. Pant Institute of Himalayan Environment and Develop, Gyanodaya Prakashan, Nainital, Uttarakhand, India, 1991.

## ***4.2 Irrigation Administration in the State – Policy, Institutional Structure, and Programmes***

### *Ancient Traditions*

Uttarakhand State, like other Himalayan States has a very old tradition of community-level informal institutional networks involved in the use and management of all natural resources, including water. These village institutional frameworks have been responsible for the creation and management of hundreds of thousands of drinking water systems [naulas, and bauries], about 20318 traditional, non-state surface flow irrigation systems or guls<sup>5</sup>, and about 50,000 gharats or water mills<sup>6</sup>.

Irrigated agriculture was practiced in the region since ancient times. It may be assumed that water mill technology has the same hoary past. A copper plate inscription of 1514 AD provides evidence of the use of water mills almost 500 years ago.<sup>7</sup> The investment in their construction and their management has been entirely in the hands of local communities.

British Colonial rule brought about a fundamental change in the management of water technologies, by introducing the paradigm of centralized rule over all natural resources by the State by the mid 19<sup>th</sup> century. Reservation was made to accommodate the local peculiarities of the hilly region, by enacting the Scheduled Districts Act in 1874, under which rules of governance could be framed separately for the area. However, the overall tendency was towards extensive State intervention in the administration of the natural resources of the region.

In case of water resources, while the state's powers to control and regulate all water resources was legally declared in 1917, the ownership rights of local communities to water sources within their village boundaries [ termed as *sal assi* boundaries due to their delineation during the revenue settlement of 1880] was recognized in law, which gave villagers the liberty to plan and implement schemes for water resource development.

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<sup>5</sup> To irrigate the land on the hill slopes, water has traditionally been brought into the fields from rivers / rivulets by means of channels called 'guls' cut along the contour line of the hills. The diversion work since earlier times has consisted of brush-wood obstruction laid across the stream by which water is diverted into 'guls' constructed at considerable effort and expense.[Walton, 1928, Gazetteer, Almora, cited in U.C.Pande, "Status of Irrigation in U.P. Hills- past and Present, " 1987.]

<sup>6</sup> Water mills are significant in relation to irrigation as very often, channels that supply irrigation also supply water mills during months when irrigation does not take place. Also, a minutely and strictly coordinated withdrawal of water for irrigation and water mill channels independently takes place from streams, necessitating a coordinated management of both. This is what happens at the community level.

<sup>7</sup> A Copper Plate grant of 1514 AD of a Chand Ruler of Kumaon refers to water mills. See N.N.Mishra and Others, "Source Materials of Kumaon History", Shree Almora Book Depot, 1994.

Village rights to water were recorded in village record of rights variously known as *Wazib-ul-Arz* or *Yaddast-Halaat-Gaon*, *Ikrarnama* or *Hukmanama*. Local customs in the use of water were officially recognized. They were recorded in village records. The convention of recording of rights of communities and individuals began in early revenue settlement procedures in 1830s. In later settlements, the records became more detailed. Forest settlement procedures that followed the implementation of forest policy also involved the recording of customary rights of villages in specific forest areas. These rights also included rights to water sources and channels constructed forest areas.

### *Irrigation Administration*

The British made no notable investment in the development of irrigation in the region, as agriculture was not considered a revenue-generating enterprise. Hill agriculture was recognized for what it was – a subsistence economy. The administration was more concerned with forests as the main source of revenue. While an extensive bureaucracy was introduced for forest management during British rule in the region, there was no separate State institutional framework for water resources administration. Regulation of water use was the responsibility of the revenue establishment.

In the Bhabhar area, at the foothills, some irrigation was developed. This was the area to which certain tribes from the hills –the Bhotias particularly - migrated during winter months, for grazing and seasonal cultivation. The Terai region, lower down was cleared of forests and settled only after 1945, towards the end of the Second World War and more increasingly after 1947. In this early period, as in the hills, the Revenue Officials supervised the construction of canals and their management, as well as regulated privately owned canals.

Disputes were settled through State - instituted judicial institutions on the basis of customary rights enjoyed by right holders. The rule was that *prior users had the first right*, and later users of water could only use water in such a way as not to injure the right of earlier users. Prior use rights formed the central legal principle, both in custom and in law, underlying water rights in the hills. British administrators recognized the rationale of this doctrine and gave statutory recognition to it. The rationale was that in the hills, significant investment of money and labour was necessary for carving out channels in the mountainside to carry water over long distances for human consumption. When any person or community had invested so much labour to do so, it would be against public policy to allow a later user of water to disturb the right accruing from such investment. Thus the ‘prior use’ doctrine was recognized in the hills while the riparian rights doctrine was not; the latter invested inherent water rights on lands abutting a flowing stream.

### *Legislation on Water*

In 1917, the first Rules for the regulation of water resources - the Kumaon Water Rules - were framed under the Scheduled Districts Act of 1874, completing the slow but steady process of bringing water resources under direct State administration. In the absence of potential for extensive commercial exploitation of water resources in the hills comparable

to forest resources, the British Government found it rational to recognize private rights (customary rights) and private enterprise in the use and development of water.

Consequently, while the Rules of 1917 declared the sovereignty of the State over all water resources in the region<sup>8</sup>, it also reiterated the existing policy of recognizing customary rights in existence.

These Rules were reenacted in 1930 to include irrigation channels as well. This was the first time that State permission was required to construct irrigation guls, though no fee was charged as for water mills. All disputes regarding either irrigation or water mills were henceforth to be settled by state officials, replacing traditional local dispute resolution institutions

Drinking water systems – naulas, springs, channels – were kept out of the purview of the rules.

### *Post Independence Developments*

After Independence, the agriculture and irrigation sector in the hill region did not receive any improved official attention. In the late seventies, the Govt of India observed that little was known about the primary factors shaping the regional agrarian structure, and that it had remained a “neglected area”.<sup>9</sup> The Second Plan of Govt. of U.P. stressed that no serious attempts had been made so far to study the local conditions.<sup>10</sup> After the Second Plan, in order to reduce regional imbalances, regional planning approach was adopted and different regions were identified in Uttar Pradesh. The hill areas were identified as one of the most backward region within its parent state of Uttar Pradesh.<sup>11</sup> It was only after the Third Five Year Plan that a separate plan for hill districts was envisaged. Since the Fourth Plan, all the then eight districts of the region, including the hilly and Terai areas were grouped together. The latter were included in the region more for administrative conveniences, in spite of the fact that there were vast disparities between the two regions in terms of topography, climate, soil quality, land tenure systems, cropping patterns, agricultural practices, population densities, etc.

With the clearance and settlement of the Terai since mid-twentieth century, irrigation development has taken place at a fast pace in that region. The mammoth administrative systems for irrigation in the U.P. which has its genesis in the British era of development of large scale irrigation, was easily extended to cover the Terai region, through a significant extension of surface canals. Private enterprise kept an equal pace in the development of ground water irrigation to cultivate the large holdings that are characteristic of the Terai. Currently, Udham Singh Nagar which is a fully Terai district, reports a percentage of NIA to NSA of 90%.

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<sup>8</sup> Declared in the Preamble to the Kumaon Water Rules of 1917.

<sup>9</sup> Ministry of Agriculture, Govt. of India, 1978, cited in H.C. Pokhriyal, “Agrarian Economy of the Central Himalaya”, Indus Publishing House, New Delhi, 1993, p.22.

<sup>10</sup> Ibid.

<sup>11</sup> UP Draft Annual Plan 1982-83, 117,p.54 and Third Five Year Plan, 140,p.47, ibid.

### *Irrigation Administration- Post Constitutional.*

Administratively, in the irrigation sector, the state irrigation agency has slowly but definitely made its presence felt since the early fifties<sup>12</sup>. Construction of state irrigation systems commenced from 1952 in the hill areas. However, Government investment in irrigation, particularly minor irrigation was nominal in the hill areas, while the Terai region cornered most of the opportunities for development. The percentage of net irrigated area to net sown area in the Terai has reached as high as 74% in 2001, while it remains at 17.8 % in the hill areas [which include partially plain areas of Nainital and Dehra Dun].

The structure and management paradigm of a centralized bureaucracy that is the Irrigation Department, created to manage large scale irrigation systems of the plains of northern India, was extended into the hill State, where conditions demand a decentralized participatory, community-based management approach. In the initial period after Independence, many of the larger farmer managed irrigation systems in the river valleys were taken over by the government for management. Steps were taken to 'modernize' these viable and healthy systems by introducing design and maintenance concepts that had been practiced and tested in the very much bigger systems of the Gangetic plains. The wrong choice of model introduced aberrations at the various stages of rehabilitation and O & M of a project<sup>13</sup>. State agencies were not adequately equipped to operate these systems. Eventually, many of the state systems are managed by the users themselves, including meting costs of minor repairs, with agency officials never available in times of need or emergency. However, irrigation agencies levy water rates for supply of irrigation water and maintenance and operation expenses are on government account<sup>14</sup>.

Throughout the period since Independence until 2000, when the state of Uttarakhand was formed, the Irrigation Department of UP was the main agency in the irrigation sector in the state. Even though minor irrigation is the predominant mode of irrigation over the larger part of the Kumaon and Garhwal regions of UP [that now constitute the new State] the Irrigation Department which usually deals with major and medium works was the dominant agency. This was primarily due to the importance given to the Ganga command canals in the Terai districts, and the relative neglect of the hill region, that was a characteristic feature of the centralized administration of Uttar Pradesh.

Since the formation of the new state, the institutional reform that has taken place is that the Minor Irrigation sector which was earlier under the administrative control of the CDO

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<sup>12</sup> U.C.Pande, supra note 1.

<sup>13</sup> Ibid.

<sup>14</sup> Ibid.

at district level, has now been made into a full fledged state level department, given the importance of minor irrigation in the State.

Briefly, the irrigation and related agencies and their functions are as follows.

1. *Irrigation Department*: Planning, Construction, Operation, Repair and Maintenance of Medium and Minor Irrigation Canals, Operation & Maintenance and Flood Control. The various programmes under which allocations for the above are made, are :-

- State Plan
- District Plan
- 20-Point Programme
- NABARD
- Scheduled Caste Sub Plan
- Scheduled Tribe Sub Plan
- CADA and AIBP under Central Assistance

2. Minor Irrigation Dept – Planning, Construction, Operation, Repair and Maintenance of Guls, Tanks, Artesian Wells, Hydrams, Bore wells, Wells. The various programmes under which allocations for the above are made are :-

- State Plan
- District Plan
- Centrally Assisted programmes – AIBP.

### *Water Rights*

Post Independence, the paradigm of water rights as maintained by the British Government was continued. Local communities' rights to water sources within their boundaries and the principle of '*prior use right*' continued to be recognized in law. The law as laid down in the Northern India Canal and Drainage Act of 1873 – that the property in the lakes, rivers and streams of British India was vested in the State, subject in certain cases to rights acquired by usage or grant – generally prevailed. The award of compensation was provided for loss of existing rights to water supply, thus recognizing earlier rights.

The Kumaon and Uttarakhand Zamindari Abolition Act was enacted in 1960. This legislation also recognized private rights to water by conferring ownership rights over a private source of water such as a well, water pond, naula etc. on the owner of the land in which it was located. Rules framed under the Act establish this by giving heritable and transferable rights on the water source to the owner of the land. Further, the Act also

provides that tanks, ponds, ferries, and water channels belonging to the state shall be managed by the Gram Sabha or any other local authority established. This last provision, however, was not actualized in Panchayat legislation.

The ownership rights to water sources that prevailed prior to British Rule and that was legally recognized throughout the colonial period was a prime condition for the successful local management of water resources that has been the characteristic of hill irrigation.

### *Community Management of Irrigation*

To date, irrigation policy has failed to take into active account the role of local communities in the construction and management of irrigation systems. The functioning of State agencies in irrigation continues with little reference to the role of farmer managed irrigation systems<sup>15</sup>.

Studies have shown that in the former eight hill districts of Uttarakhand, community irrigation systems cover an area which is more than twice that reported under government irrigation systems<sup>16</sup>. Yet, until the Centrally sponsored Minor Irrigation Census of 1985-87, there was no official record of the number of such traditional systems or the area that they irrigated independently.

*The official record of irrigated area in the region shown as irrigated by State systems either did not reflect the actual entire irrigated area or it included the FMIS irrigated area as part of that achieved under State systems. In both cases, it constituted a serious lapse or error in terms of irrigation policy and planning.*

The pattern of management of community systems is closely related to local social and economic conditions and is therefore not uniform.

The social structure of local communities in Uttarakhand is distinct. The majority of villages is uni-caste or uni-lineage, which contributes to maintaining a close cooperation in conducting the various operations relating to agriculture and irrigation. Even where there are two or more than two castes in a village, social norms and institutions have been created to establish and maintain local cooperation which is quite essential to meet the hardships presented by the difficult terrain and environmental conditions.

In most villages, local committees representing the different household or family groups are formed to plan the distribution of water, repair and maintenance of the systems, and

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<sup>15</sup> This is in stark contrast to Himachal Pradesh, where community managed irrigation systems have been statutorily recognized since 1905 – when the state was part of the Punjab Province – and under the HP Minor Canals Act 1976 since the new State was formed.

<sup>16</sup> U C Pande, 'Irrigation Management in a FMIS in U.P. Hills – Consequences of Water Rights Dilution' undated.

other related tasks. In some cases, societies of irrigating farmers are formed. Pande reports another system of management from Pithoragarh district, called the Hara system. Under this system, irrigating farmers enter into a written contract with a contractor who undertakes to repair and maintain the irrigation channel and to deliver water at the field to all farmers in the command. For this service, he is paid either in cash or kind – the latter as a proportion of the harvest from every field. The contractor employs such labour as is necessary for the task.

Thus the entire expenditure towards construction, repair and maintenance of irrigation systems and the distribution of water is met by the farming community in almost the entire irrigated area of the State.

### *1975 – A Watershed in Water Resources Administration*

Prior to 1975, springs, streams and channels within village boundaries were under either private or village ownership and control; “Prior use rights” were recognized in law. The Kumaon Water Rules of 1930 were the only statutory rules regulating water use in the hills. Their objective was to regulate the construction of irrigation channels and water mills. These Rules permitted private and community enterprise in construction, subject to permission, and provided for resolution of conflicts of rights on the basis of ‘prior use’ rights.

The 1975 Act abolished all existing customary rights over water, whether individual or otherwise, and declared State proprietorship over all sources. This was to facilitate the provision of drinking water by State agencies to the region as a whole, which was experiencing water shortages.

Drinking water has been made a priority. Water is abstracted from any available source to supply to nearby villages. A major development has been the supply of drinking water to burgeoning urban populations from rural water sources such as rivers and streams.

Stated in a nutshell, under this Act, the rights of the State on water prevails over all water use by any individual, community or groups of persons, firms or institutions. In any conflict between State rights and other rights, the rights of the State will prevail.

In all other situations, i.e., conflicts between individuals, communities etc., where the rights of the State are not in contention, the Kumaon Water Rules of 1930 would apply (i.e. prior use rights will prevail) as provided for under section 22 of the Kumaon and Garhwal Water Act of 1975.

No Rules were framed under the Kumaon and Garhwal Water Act of 1975. It has been used mainly as a substantive Act to enforce the rights of the State. Other useful provisions of the Act - e.g. sections relating to water conservation - have never been implemented.

This policy, combined with a lack of sustainable, integrated natural resources conservation and management policy, over the last several decades has had a deleterious

impact on the status of irrigation across the State, which is summarized in the next part.

### *Role of Panchayats*

Panchayat Institutions have had a meagre role to play in the matter of irrigation. Panchayat legislation hitherto has not empowered PRIs in the matter of irrigation. At the policy level, with the implementation of the JRY scheme, Village Panchayats have been able to allocate expenditures on minor irrigation within their jurisdictional areas. Subsequent to the Constitutional Amendments on Panchayat Raj, it is to be expected that the mandate to PRIs would be increased. Of the subjects listed in the 11<sup>th</sup> Schedule to the Constitution to be brought under the purview of PRIs, is included minor irrigation.

Since the formation of the new State, Panchayat legislation is still to be amended.

### *Draft Water Policy, Government of Uttarakhand*

In 2003, the Govt. of Uttarakhand prepared a Draft Water Policy for the State. The Draft Policy spells out certain important principles of water resources development and management, i.e.

- Integrated Natural Resources Management through Watershed Approach.
- Empowerment of PRIs to plan, construct and manage Rural Irrigation systems.
- Involvement of Local communities in planning and implementation.
- Planning processes to include traditional rights and systems.
- Well developed information system.
- Planning on the basis of hydrological units.
- Creation of watershed institutions.
- Integrated and multi-disciplinary approach to the planning, formulation, clearance and implementation of projects; close integration of water-use and land-use policies.
- Integrated and coordinated development of surface water and ground water resources and their conjunctive use.
- Encouragement of private sector.
- Encouragement of Water Mills and vesting their management with Panchayats.
- Necessary legislation for preservation of existing water bodies by preventing encroachment, regulation to ensure no pollution on the banks of rivers and streams, and deterioration of water quality.
- Compulsory percentage of budget allocation fixed for water harvesting and water conservation structures
- Flood and Disaster Management

However, the policy is yet to be enacted.

## *Conclusion*

The irrigation history of Uttarakhand reveals a rich social tradition and experience in the management of water for improving agricultural productivity. It is clear that the State has not kept pace with the initiatives of society in this task. British Colonial rulers wisely left irrigation management to local communities who had proved their efficiency over time. It was also a sound economic policy of the State not to engage in an enterprise that required high levels of financial investment that could only be offset by the voluntary labour of millions of farmers in far and out-flung areas in difficult hilly terrain.

Since Independence, the domination of the 'welfare State' relegated the body public to a "recipient" status that ignored the skills, knowledge and capacity of farmers to develop agriculture and irrigation. Irrigation administration in the State has shown a lack of appreciation and information about public participation which led to ignoring this critical feature. The lack of a supportive policy and legal framework has strengthened this neglect.

### ***4.3 Status of Irrigation in Uttarakhand***

A review of literature on the subject of agriculture and irrigation shows that agrarian studies with respect to this hill state have been few and far between. Such studies as there are, are limited in focus, presenting case studies with a district level rather than state level analysis<sup>17</sup>. The irrigation sub-sector as a whole has been of equally low interest to the scientific and academic community in this region, with a few exceptions<sup>18</sup>. These can be seen as the only reference material available in Uttarakhand other than the official statistical records of the Govt. of Uttarakhand.

With respect to official data, there is a multiplicity of sources of statistical data. The various sources for State level data are State Department of Economics and Statistics, Irrigation Department, Minor Irrigation Department, and the erstwhile Soil & Water Conservation Department [which is now part of the Watershed Directorate].

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<sup>17</sup> H.C.Pokhriyal, "Agrarian Economy of the Central Himalaya", Indus Publishing House, New Delhi, 1993.

<sup>18</sup> U.C. Pande, 'Status of Irrigation in U.P.Hills – Past and Present', 1987; "Irrigation Management in an FMIS in U.P. Hills- Consequences of water rights dilution", undated.; M.S. Vani and Rohit Asthana, DCAP, "Empowered State and Eroded Water Rights in Uttarakhand – A Study of Water Disputes in Almora District", Unpublished Monograph, 1996; .; M.S. Vani and Rohit Asthana, DCAP, "Law and Custom in Water Resources Administration: Case Study of Uttarakhand", Unpublished Monograph, 1997; R. Swarup, "Agricultural Economy of Himalayan Region with special reference to Kumaon", 1991

This is discussed below.

#### ***4.4 Irrigation Infrastructure***

Information on irrigation infrastructure is available from four official sources.

- (i) State Directorate of Economics and Statistics.
  - (ii) Irrigation Department
  - (iii) Minor Irrigation Department
  - (iv) Minor Irrigation Census, Govt of India, 1986-87; 2000-01.
- (i) The latest State level statistics (State Directorate of Economics and Statistics) gives the following picture of the irrigation infrastructure in Uttarakhand.

Table 4. Overview of Irrigation Status

	<i>IRRIGATION</i>			
(A)	<i><u>Net and Gross Irrigated Area</u></i>			
1.	<i>Canals</i>	2004-05	Hectare	95720
2.	Tube Wells	2004-05	Hectare	206229
3.	Other Wells	2004-05	Hectare	7528
4.	Tanks/ Ponds	2004-05	Hectare	999
5.	Other Sources	2004-05	Hectare	34748
6.	Net Irrigated Area (NIA)	2004-05	Hectare	345224
7.	Gross Irrigated Area (GIA)	2004-05	Hectare	549345
(B)	Irrigation Infrastructure			
1.	Length of Canals	2006-07	Km.	8238
2.	Length of Lift Canals	2006-07	Km.	141
3.	Tube Wells (State)	2006-07	No.	782
4.	Pump Sets ( Boring/ Free Boaring)	2006-07	No.	53795
5.	<i>Hauj</i>	2006-07	No.	23939
6.	<i>Gool</i>	2006-07	Km.	17526
7.	Hydram	2006-07	No.	1422
8.	C.C.A. Under State Canal	2006-07	Lakh Hect.	2.88
9.	Revenue Collection by Irrigation	2006-07	Rs. Lakh	223.67

Source: Directorate of Economics and Statistics, Govt of Uttarakhand 2008

The following observations can be made from the above.

- While some of the systems are indicated in numbers [tube wells, pump sets, hauj], others such as canals and guls are indicated in length. [Kms]. As such the number of irrigation systems cumulatively is not clear.
  - Also not represented is the numbers of the systems according to the major types – major, medium or minor systems.
  - The consolidated data at the state level also does not provide district wise differences on the number and type of systems.
  - The length of ‘Canals’ in the second part is shown as 8238 Kms. The length of ‘Gools’ is given as 17526 Kms, showing the predominance of traditional irrigation systems in terms of length. In many cases state agencies undertake repair and reconstruction of traditional guls. It is not clear whether these are also included in the definition of state canals.
  - With these differing parameters, no assessment can be made from this State level consolidated data, which will throw light on the irrigation infrastructure of the state in terms of the numbers of different types of systems, their district wise distribution, their ownership [whether private or state] and the area irrigated by each type for a particular year [in this case 2006-07].
- (ii) The Irrigation Department has provided the following data for the year 2008.
- District wise numbers, CCA and irrigation potential proposed [but not achieved] for canals, tube wells and pump canals.
  - In addition to the above, data is also provided on specific schemes, the estimated costs, and actual expenditure on various schemes such as
    - Flood Control
    - AIBP
    - 20-point programme
    - NABARD
  - Thirdly, a list is provided of schemes sanctioned for the year, for canals and tube wells [repair and construction] with estimated costs and actual expenditure
  - Fourthly, data on schemes under construction under the Scheduled Caste Component Plan, including a district wise list of specific schemes, the amount sanctioned and expenditure.
  - Fifthly, a list of schemes under Tribal Sub Plan, with specific schemes, estimated costs, sanctioned amount and expenditure.

Table 5. No. of Canals Constructed by ID till February, 2008

S. No	District	No. of Canals	CCA [Lakh Ha]	Proposed Irrigation Potential [Lakh Ha]		
				Kharif	Rabi	Total
<b>Garhwal Division</b>						
1	Dehradun	265	0.294	0.176	0.153	0.329
2	Tehri	232	0.054	0.035	0.027	0.062
3	Uttarkashi	185	0.070	0.039	0.020	0.059
4	Pauri	300	0.089	0.056	0.054	0.110
5	Rudraprayag	128	0.042	0.023	0.017	0.040
6	Chamoli	174	0.050	0.026	0.024	0.050
7	Hardwar	06	0.025	0.025	0.012	0.037
<b>Total Garhwal</b>		<b>1290</b>	<b>0.624</b>	<b>0.380</b>	<b>0.307</b>	<b>0.687</b>
<b>Kumaon Division</b>						
8	Nainital	269	0.379	0.281	0.324	0.605
9	U.S. Nagar	225	0.945	0.554	0.332	0.886
10	Almora	176	0.051	0.035	0.035	0.070
11	Pithoragarh	162	0.044	0.028	0.027	0.055
12	Bageshwar	131	0.034	0.027	0.027	0.054
13	Champawat	78	0.022	0.015	0.014	0.029
<b>Total Kumaon</b>		<b>1041</b>	<b>1.475</b>	<b>0.940</b>	<b>0.759</b>	<b>1.699</b>
<b>Total Uttarakhand</b>		<b>2331</b>	<b>2.099</b>	<b>1.320</b>	<b>1.066</b>	<b>2.386</b>

Irrigation Department, 2008, Uttarakhand

Table 6. Nos. of Tubewells / Pump Canals Constructed by ID till February, 2008

S. No	District	No Of Tubewells	No. of Pump Canals	CCA [Lakh Ha]	Proposed Irrigation Potential [Lakh Ha]		
					Kharif	Rabi	Total
<b>Garhwal</b>							
1	<u>Dehradun</u>						
	<i>Tubewells</i>	106	–	0.085	0.085	0.085	0.170
	<i>Pump Canals</i>	–	3	0.004	0.002	0.002	0.004
2	<u>Pauri</u>						
	<i>Tubewells</i>	27	–	0.025	0.025	0.025	0.050
	<i>Pump Canals</i>	–	2	–	–	–	–
3	<u>Uttarkashi</u>						
	<i>Tubewells</i>	–	–	–	–	–	–
	<i>Pump Canals</i>	–	11	0.004	0.003	0.003	0.006
4	<u>Tehri</u>						
	<i>Tubewells</i>	–	–	–	–	–	–
	<i>Pump Canals</i>	–	4	0.002	0.001	0.001	0.002
5	<u>Rudraprayag</u>						
	<i>Tubewells</i>	–	–	–	–	–	–
	<i>Pump Canals</i>	–	5	0.002	0.001	0.001	0.002
6	<u>Chamoli</u>						
	<i>Tubewells</i>	–	–	–	–	–	–
	<i>Pump Canals</i>	–	4	0.001	0.001	0.001	0.002
7	<u>Hardwar</u>						
	<i>Tubewells</i>	252	–	0.237	0.065	0.113	0.178
	<i>Pump Canals</i>	–	–	–	–	–	–

Contd—

S. No	District	No Of Tubewells	No. of Pump Canals	CCA [Lakh Ha]	Proposed Irrigation Potential [Lakh Ha]		
					Kharif	Rabi	Total
<b>Kumaon</b>							
8	<u>Nainital</u>						
	<i>Tubewells</i>	159	–	0.144	0.086	0.057	0.143
	<i>Pump Canals</i>	–	9	0.006	0.004	0.003	0.007
9	<u>U.S. Nagar</u>						
	<i>Tubewells</i>	258	–	0.269	0.162	0.108	0.270
	<i>Pump Canals</i>	–	–	–	–	–	–
10	<u>Champawat</u>						
	<i>Tubewells</i>	16	–	0.014	0.008	0.006	0.014
	<i>Pump Canals</i>	–	1	–	–	–	–
11	<u>Almora</u>						
	<i>Tubewells</i>	–	–	–	–	–	–
	<i>Pump Canals</i>	–	43	0.008	0.006	0.006	0.012
12	<u>Bageshwar</u>						
	<i>Tubewells</i>	–	–	–	–	–	–
	<i>Pump Canals</i>	–	21	0.004	0.003	0.002	0.005
13	<u>Pithoragarh</u>						
	<i>Tubewells</i>	–	–	–	–	–	–
	<i>Pump Canals</i>	–	5	0.002	0.001	0.001	0.002
<b>Total Uttarakhand</b>							
	<b><i>Tubewells</i></b>	<b>818</b>	<b>–</b>	<b>0.774</b>	<b>0.431</b>	<b>0.394</b>	<b>0.825</b>

<b>Pump Canals</b>	<b>–</b>	<b>108</b>	<b>0.033</b>	<b>0.022</b>	<b>0.020</b>	<b>0.042</b>
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### *Analysis of Irrigation Department Data on Irrigation Infrastructure*

- If we look at the two tables above, the cumulative number of canals is 2331. The number of tube wells is 818, and the number of pump canals is 108, bringing the total of systems under ID to 3257. The *proposed* [gross] irrigation potential under the three types of systems is given as 3.253 lakh hectares. *However, the actual irrigation potential created is not provided.*
- The latest data of 2008 is not reflected in the state level data, which gives the information on irrigation infrastructure as per 2006-07. In this latter data, information on canals and lift canals is given in differing parameters – length in kilometers, whereas the departmental data provides information of canals and tube wells in numbers. At the same time, the ID data for 2008 does not say how many new canals or tube wells are proposed for the year, but only provides data on proposed irrigation potential to be created [ not actual achieved].
- In conclusion, it may be stated that the data from the Irrigation Department is insufficient to compensate for the lacunae in the State level data on irrigation infrastructure published by the Directorate of Economics and Statistics, because in itself, it contains discrepancies.

### *District Level Differences*

The ID data shows there are no major irrigation schemes in the State. Of the medium schemes, data on the numbers of canals and their lengths are provided. There are more canals in the Garhwal than the Kumaon region. However, information on their respective lengths is not available for comparison.

In the Garhwal region, Pauri district has the largest number canals, while Nainital has a larger number of canals in the Kumaon region. Tubewells are concentrated in the Terai Districts- with only Pauri and Champawat also having tubewells as some parts of these hill districts border the Terai and are plain.

(iii) *Minor Irrigation Department*

The Minor Irrigation Department also maintains data on its systems. The data for the years 2004-05 to 2007-08 is presented below. It presents the target and achievement for the year district wise and state level, but not the consolidated figures for all years, as was done previously. Budget estimates and actual expenditure for the year are also provided. However, this data is not useful to arrive at an estimate of the total number of minor irrigation systems in the State, type wise and district wise and the area irrigated by them.

Table 7. Year-wise type of systems constructed by MI Department

S. No	Annual Plan	Weir		Minor Irrigation Gul [Km]		Hauz [No]		Hydram [No]		Artesian Well [No]		Boring Pumpset [No]		Deep Boring [No]		Irrigation Potential [Hectares]	
		T	A	T	A	T	A	T	A	T	A	T	A	T	A	T	A
1	2004-05			375.0	687.13	100	311	36	71	8	8	141	162	0	0	2917.20	5339.71
2	2005-06	-	-	900	1760.809	200	636	36	101	10	02	50	184	0	0	6101.00	19529.517
3	2006-07	-	-	3112.000	2238.701	1177	1209	45	39	10	7	50	264	0	0	20409.00	21563.733
4	2007-08	2	2	2333.000	1174.074	900	1367	7	33	10	4	0	232	0	0	15000.00	12270.502

(iv) *The Minor Irrigation Census.*

Minor Irrigation Census 1986-87

This all-India census was instituted by a Government of India program in 1986-87. For the first time, it brought focus to small irrigation systems including traditional irrigation systems, after nearly four decades of priority attention given to large scale dam-based irrigation in the country. This is a Quinquennial Census, repeated after every five years.

In Uttarakhand, the first census took place in 1986-87. For the first time, the census identified irrigation systems according to ownership.

This clearly establishes that until this census was conducted, all the irrigation systems in the state were assumed to belong to Government, and all the irrigated area attributed to Government action, as the data on irrigation systems and irrigated area reflected only government constructed systems.

Until recently, the MI census was dealt with independently and not incorporated into the data base and planning processes of the MI Department. Table 8 for instance shows how, until 1993, the MI department reported data by the old format, disregarding the issue regarding ownership of minor irrigation systems.

Table 8. MINOR IRRIGATION WORKS IN 8 DISTRICTS OF KUMAON AND GARHWAL REGION [1993]

DISTRICT	DUG WELLS (NOS)	PERSIAN WHEELS (NOS)	PUMP SETS (NOS)	ELEC. TUBE WELL (NOS)	BORING PUMP SET (NOS)	ARTESIAN WELL (NOS)	HYDRAM (NOS)	HAUZ (NOS)	GUL (KMS)
Almora	-	-	-	-	-	-	86	2284	1644
Pithoragarh	-	-	-	-	-	-	71	1933	538
Dehradun	30	1	8	251	500	-	126	406	736
Chamoli	-	-	-	-	-	-	108	1439	600
Uttarkashi	-	-	1	-	-	-	108	944	1002
Pauri	-	-	-	-	-	-	130	2117	1165
Tehri	13	-	-	4	15	-	128	2004	2674
Nainital	6	4	857	5654	17645	122	69	1830	1054
Total	<b>49</b>	<b>5</b>	<b>865</b>	<b>5909</b>	<b>18160</b>	<b>122</b>	<b>826</b>	<b>12957</b>	<b>9413</b>

Source – MI Census, 1993

As per the 1986-87 Census, there were a total of **33004** minor irrigation systems in the State. 11 % of the systems belonged to Government whereas 89 % belonged to “public organizations” or “private societies”. These two terms are not defined in the Census. From field observations, it can be stated that “public organizations” are village communities as a whole, while “private societies” are groups of farmers who own and operate guls. Thus, it is clear from this Census that community participation in the development and management of minor irrigation has been far more significant than the Government’s. This is particularly the case in the hill region where there is an almost complete absence of major and medium schemes.

This Census for the first time confirms the historical fact that it was the farming community that has been primarily responsible for irrigation development in the hill regions of Uttarakhand.

The Census shows that of the total 33004 minor irrigation systems inventoried, 75 % were in use, whereas 25 % were not in use. However, the data does not show the functionality of systems as per ownership. As a result, it is not possible to say from this data whether State systems or community/ private systems are more successful. Again, from field observations, it can be stated clearly that community systems have been far more successful and have been functioning for decades and centuries.

**Most important, the data does not show the area irrigated according to ownership of systems. This information would have further clarified the respective roles of the State and community in irrigation development in the State.**

The Census further provides data on surface flow and lift systems in terms of numbers and area irrigated.

### MI Census 2000-2001

The report of the second MI census was published in 2000-01. It presents a far more detailed picture of the minor irrigation in the State than the previous census. In this census, data on minor irrigation systems have been provided with respect to several parameters in addition to total numbers of MI systems.

*Total Number of Minor Irrigation Systems*

TABLE 9. MINOR IRRIGATION SCHEMES AT A GLANCE [ M.I. CENSUS: 2000-2001]

S. No	Districts	No of Blocks	No of Villages	Total Nos. of Schemes					Total
				Dug well	Shallow	Deep	S. Flow	S. Lift	
1	Almora	11	2235	0	0	0	3346	82	3428
2	Bageshwar	3	915	0	0	0	1558	47	1605
3	Chamoli	9	1220	0	0	0	1621	59	1680
4	Champawat	4	690	0	628	6	827	12	1473
5	Dehradun	6	718	19	178	79	867	33	1176
6	Haridwar	6	651	242	26031	214	19	2	26508
7	Nainital	8	1082	1	559	169	3161	85	3975
8	Pauri	15	3525	1	0	15	2611	99	2726
9	Pithoragarh	8	1624	0	0	0	3416	104	3520
10	Rudraprayag	3	689	0	0	0	743	15	758
11	Tehri	9	1815	0	0	0	4777	61	4838
12	U.S.Nagar	7	669	574	24703	400	483	83	26243
13	Uttarkashi	6	669	0	0	0	2097	26	2123
<b>TOTAL</b>		<b>95</b>	<b>16502</b>	<b>837</b>	<b>52099</b>	<b>883</b>	<b>25526</b>	<b>708</b>	<b>80053</b>

From the above table, it can be seen that MI systems number around 80053, a jump from the total of 33004 systems inventoried in the previous Census. This is because of the addition of a new category – shallow and dug wells- in the Census. The greater number is accounted for by shallow wells, which are mostly farmer-constructed. The next highest category is surface flow systems. In the Terai districts, the numbers of surface flow systems are far less than in the hill areas. *It is a matter of significance that there are more than 25000 surface flow systems in the hill areas, the vast majority of which are again farmer constructed systems.*

### *District Level Differences*

#### Presence of MI systems

<b>High Levels</b>	<b>Low Levels</b>
▪ Haridwar [Plains]	▪ Rudraprayag [Hills]
▪ Udham Singh Nagar [Plains]	▪ Dehradun [Valley]
▪ Tehri [Hills]	▪ Champawat [Hills]
▪ Nainital [Hills, Partly Plains]	▪ Bageshwar [Hills]
▪ Pithoragarh [Hills]	▪ Chamoli [Hills]
▪ Almora [Hills]	▪
▪ Pauri [Hills]	▪

In terms of availability of minor irrigation infrastructure, the two plains districts – Haridwar and Udham Singh Nagar - top the list, with four hill districts – Tehri, Pithoragarh, Almora and Pauri also featuring in the list due to the prevalence of flow systems.

In terms of low availability of MI systems – four hill districts feature in the list - Rudraprayag, Champawat, Bageshwar and Chamoli. Dehra Dun which has larger systems, also features in the list.

#### Functionality

<b>High Levels</b>	<b>Low Levels</b>
▪ Haridwar [Plains]	▪ Rudraprayag [Hills]
▪ Udham Singh Nagar [Plains]	▪ Almora [Hills]
▪ Nainital [Hills, Partly Plains]	▪ Chamoli [Hills]
▪ Tehri [Hills]	▪ Bageshwar [Hills]
▪ Dehradun [Valley]	▪ Pauri [Hills]
▪ Uttarkashi [Hills]	▪ Pithoragarh [Hills]

In terms of functionality, again the plains districts predominate. Of the hill districts, those which had a sizeable number of systems – Almora, Pithoragarh, and Pauri - show low levels of functionality. Thus, in spite of having irrigation systems, hill districts are disadvantaged by low functionality of systems, which fact is borne out by the data on irrigated area as well.

### *Summary of Data on Irrigation Infrastructure*

From the above analysis, it can be observed that the four different sources of data [State level consolidated data from Department of Economics and Statistics, Irrigation Department, Minor Irrigation Department, and Minor Irrigation Census] do not present a coherent picture on irrigation infrastructure.

- The State level consolidated data indicates all types of irrigation technologies, but in different parameters, so that a total number cannot be arrived at. This data is also different from the other two sources of data.
- The Irrigation Department provides data on major, medium and minor systems. However, these reflect different parameters and do not tally either with the State level data or the MI Census.
- The MI Census provides data only on MI systems, and not on Major / Medium systems. Among the three it represents a more accurate picture, though there are no means to verify them.

### *Other data on MI systems.*

In addition to the numbers of systems, the MI Census 2000-01 provides data on other aspects of MI systems such as:

- a) Ownership
- b) Construction of systems over the years.
- c) Holding size
- d) Social status
- e) Functional Status
- f) Financial source
- g) Irrigation potential created through surface flow and ground water systems
- h) Constraints in utilization of irrigation.

A selection of this data is presented below.

### *MI Flow Systems according to social status of farmers*

A new parameter included in the current MI Census is with respect to social status of farmers. This helps in assessing how far the benefits of irrigation are reaching the underprivileged in society. The data presents such information only with respect to systems owned by individual and groups of farmers, which account for only 59 % of the total MI systems. The surface flow systems for which the information is presented,

represents only 30 % of all flow systems. The social status of farmers in all the systems would have given a better state level picture. On the existing data, therefore, only a restricted understanding of this important parameter is possible.

Table – 10. DISTRIBUTION OF IRRIGATION SYSTEMS ACCORDING TO SOCIAL STATUS

S. No	Type of Irrigation Systems	Social Status of Farmers					Grand Total
		Scheduled Caste	Scheduled Tribe	Others	Total [SC+ST+ Others]	Owned by other than Individual / Group of Farmers	
1.	Dug Wells	71	30	617	718	119	837
2.	Shallow Tubewells	6636	4897	40229	51762	337	52099
3.	Deep Tubewells	3	2	66	71	812	883
4.	Surface Flow Systems	870	332	6576	7778	17748	25526
5.	Surface Lift Systems	2	2	72	76	632	708
6.	<b>Total</b>	<b>7582</b>	<b>5263</b>	<b>47560</b>	<b>60405</b>	<b>19648</b>	<b>80053</b>

1 – Dug Wells – Data from 5 Districts only.

2 – Shallow Tubewells – Data from 5 Districts only.

3 – Deep Tubewells – Data from 6 Districts only.

4 – Surface Flow systems – Data from all 13 Districts.

5 – Surface Lift Systems – Data from all 13 Districts.

The data is significant only in terms of shallow tube wells, in which case, the tube wells owned by Scheduled Castes amounts to 12 % and those owned by Scheduled Tribes amount to 9.4 %. In the case of flow systems, the percentage of systems belonging to Scheduled Castes is 11%, whereas that belonging to Scheduled Tribes is far less at 4 %. Among the districts, the plain areas of Nainital and Dehradun account for a larger number of owners belonging to Scheduled Castes and Tribes, as their proportion of the population is larger in these areas.

#### *Functional Status of Irrigation Systems*

The MI Census also gives data on the functional status of systems. As per the table below, 90.79 % of MI systems are reported as functional. The MI Census of 1986-87 reports a more modest figure of 74.75 % systems in use. 95 % of dug wells, 98 % of shallow wells, 97 % of deep tube wells, 74 % of surface flow systems and 86 % of surface lift systems are reported to be in use.

Only four reasons for non-functionality are specified – temporarily abandoned, dried up, salinity and destroyed. The term ‘others’ is not specified. Surface flow systems show the largest percentage of ‘non-functionality’ – 25.5 % - compared to 4.5 % for dug wells, 1.3 % for shallow wells, 3 % for deep tube wells and 13.7 percent for surface lift wells.

Table 11. DISTRIBUTION OF IRRIGATION SYSTEMS ACCORDING TO FUNCTIONAL STATUS

S. No	Type of Irrigation Systems	Scheme in Use	Schemes not in Use					Grand Total	
			Temporarily Abandoned	Salinity	Dried up	Destroyed/ Sinking	Others		Total
1.	Dug Wells	799	29	5	4	0	0	38	837
2.	Shallow Tubewells	51416	525	89	49	9	11	683	52099
3.	Deep Tubewells	857	12	2	4	8	0	26	883
4.	Surface Flow Systems	19003	2793	1282	937	876	635	6523	25526
5.	Surface Lift Systems	611	67	8	2	3	17	97	708
6.	<b>Total</b>	<b>72686</b>	<b>3426</b>	<b>1386</b>	<b>996</b>	<b>896</b>	<b>663</b>	<b>7367</b>	<b>80053</b>

- 1 – Dug Wells – Data from 5 Districts only.
- 2 – Shallow Tubewells – Data from 5 Districts only.
- 3 – Deep Tubewells – Data from 6 Districts only.
- 4 – Surface Flow systems – Data from all 13 Districts.
- 5 – Surface Lift Systems – Data from all 13 Districts.

The Census however, does not give information of the *level of functionality*. In other words, some of these systems may be fully functional, while others may be partially functional. Such data are usually available at the field level offices of the respective departments, but are not captured in the State level data consolidation process.

### *Financial Source of Systems*

The following table shows that of the total number of MI systems, 21.6 % are government funded, while the rest are supported by other than government sources. Since government owned systems constitute 8.47 % of total systems, this figure suggests that government support is made available for other systems as well. However, there is no definition of “financial source” – whether it refers to full or partial support, intermittently or continuously.

TABLE 12. DISTRIBUTION OF IRRIGATION SYSTEMS ACCORDING TO FINANCIAL SOURCE

S. No	Type of Irrigation Systems	Source of Finance for Constructing Schemes						Grand Total
		Govt Fund	Farmer's Saving	Loans & Savings	Subsidy & Bank Loan	Subsidy Only	Others	
1.	Dug Wells	-	-	-	-	-	-	-
2.	Shallow Tubewells	3748	38329	4494	4359	991	178	52099
3.	Deep Tubewells	526	104	56	14	-	183	883
4.	Surface Flow Systems	13044	2579	314	1465	6861	1263	25526
5.	Surface Lift Systems	-	404	52	19	-	233	708
6.	<b>Total</b>	<b>17318</b>	<b>41416</b>	<b>4196</b>	<b>5857</b>	<b>7852</b>	<b>1857</b>	<b>80053</b>

1 – Dug Wells – Data Not Available

2 – Deep Tubewells – Data on Subsidy Only Not Available.

3 – Surface Lift Systems – Data on Govt Fund and Subsidy Not Available.

#### 4.5 Area Irrigated

The same sources of data are examined for information on irrigated area in the State.

#### State Level Data

(i) State level consolidated data [Part A of Table below]

#### Overview of Irrigation Status

	<i>IRRIGATION</i>			
(A)	<i>Net and Gross Irrigated Area</i>			
1.	<i>Canals</i>	2004-05	Hectare	95720
2.	Tube Wells	2004-05	Hectare	206229
3.	Other Wells	2004-05	Hectare	7528
4.	Tanks/ Ponds	2004-05	Hectare	999
5.	Other Sources	2004-05	Hectare	34748
6.	Net Irrigated Area (NIA)	2004-05	Hectare	345224
7.	Gross Irrigated Area (GIA)	2004-05	Hectare	549345
(B)	Irrigation Infrastructure			
1.	Length of Canals	2006-07	Km.	8238
2.	Length of Lift Canals	2006-07	Km.	141
3.	Tube Wells (State)	2006-07	No.	782
4.	Pump Sets ( Boring/ Free Boaring)	2006-07	No.	53795
5.	<i>Hauj</i>	2006-07	No.	23939
6.	<i>Gool</i>	2006-07	Km.	17526
7.	Hydram	2006-07	No.	1422
8.	C.C.A. Under State Canal	2006-07	Lakh Hect.	2.88
9.	Revenue Collection by Irrigation	2006-07	Rs. Lakh	223.67

Source: Directorate of Economics and Statistics, Govt of Uttarakhand 2007

- The above data does not differentiate medium and minor systems, their numbers and area irrigated.
- Source wise irrigated area is provided for the year 2004-05, but not for 2006-07. Thus a comparison and a review of developments is not possible.
- The net irrigated area for 2004-05 is shown to be 3.45224 lakh hectares. However, the net irrigated area for 2006-07 is not given, making it difficult to compare and assess the growth and current status.
- Instead, the CCA under State canals is shown for 2006-07 as 2.88 lakh ha [but not for 2004-05, making a comparison on this aspect also problematic.] As a result, it is difficult to gauge the current status of Net Irrigated Area from all sources.

- The CCA under state canals for 2006-07 is 2.88 Lakh Ha. This is less than the Net Irrigated Area of Canals and Tube wells [95720 + 206229 = 301949 Ha].
- The total length of surface canals in the State is [8238 + 141 + 17526] 25905 Kms. Of this, State canals account for 32.4 %, in comparison to 67.6 % of the total length of canals constituted by traditional guls. **However, the irrigated area under State canals is reported to be 89.7 % of the total irrigated area under surface canals, compared to 10.3 % of the irrigated area that is attributed to traditional guls or “Other Sources” [guls are not shown in the first part as a type of system].** This conclusion is not substantiated by the Minor Irrigation Census, which examined the traditional guls – 215230.
- The term ‘Other Sources’ is not defined. The table also does not indicate the distinction between systems / area irrigated in the hill area as compared to the Terai region. There is no indication of district wise irrigation achievements.

Another set of data issued by the Directorate of Economics and Statistics gives a different picture of the irrigated area of the state. The following table shows the Irrigation Potential Created and Actual Irrigation Achieved in gross terms.

*This table is significant in the sense that it is the only set of data that seems to show the situation in the state as it prevails i.e.*

- *That minor irrigation is more significant than major and medium.*
- *That private irrigation is more significant than state irrigation in the minor irrigation sector.*

Table 13. Year-wise Irrigation Potential Created and Actual Irrigation Achieved under different categories of Irrigation Sector in Uttarakhand (in 000 Ha)

S. No	Item	Minor Irrigation		Total Minor Irrigation	Major & Medium Irrigation	Total
		State	Private			
(1)	(2)	(3)	(4)		(5)	(6)
1	2004 – 2005					
	(a) Potential	278.80	337.62	616.42	32.20	648.62
	(b) Actual	232.00	250.45	482.45	37.20	508.05
2	2005 – 2006					
	(a) Potential	279.20	357.10	636.30	32.25	668.55
	(b) Actual	234.60	250.20	484.80	37.20	522.00
3	2006 – 2007					
	(a) Potential	286.90	378.71	665.61	32.20	697.81
	(b) Actual	231.20	265.10	496.30	37.20	533.50

Note: In the figures under Irrigation Potential and Actual Irrigation, GIA has been shown  
Source – Directorate of economics and Statistics, State Planning Department, GoUK;  
<http://gov.ua.nic.in>

(ii) *Irrigation Department*

Data from the Irrigation Department is presented below.

Table 14. Performance of Irrigation Department 2000-08[In Lakh Ha]

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08
Culturable Command Area [CCA]	2.609	2.629 +0.020	2.681 +0.052	2.691 +0.010	NA	2.8545 +0.1635	NA	2.099 - 0.7555
Net Irrigated Area [NIA]	2.278	2.279 +0.001	2.355 +0.076	2.541 0.186	NA	NA	NA	NA
Cropwise Irrigated Area Kharif	1.136	1.16 + 0.024	1.266 + 0.106	1.34 + 0.074	1.266 - 0.074	1.285 [proposed]	NA	1.320 [proposed]
Rabi	1.142	1.119 -0.023	1.089 -0.03	1.201 0.112	1.314 0.113	1.035 [proposed]	NA	1.066 [proposed]
Total of Kharif and Rabi	2.278	2.279	2.355	2.541	2.58	2.32	NA	2.386
Revenue Generation [in Lakh Rs]	105.119	105.916 +0.797	130.401 +24.485	180.537 +50.136	190.00 +9.463	192.00 +2.00	NA	NA

Source: Official Annual reports of Irrigation Department Uttarakhand 2000-08.

[+ = Annual increments]

- After increasing by 24550 hectares between 2000 and 2006, the CCA has reduced by 75550 between 2006 and 2008, and overall by 51000 hectares between 2000 and 2008.
- With respect to NIA, 26300 hectares have reportedly been added between 2000 and 2004 through the Irrigation Department, but the figures are not provided for the following years.
- The Irrigated Area for Kharif has increased by a small figure of 20000 hectares between 2000 and 2003-04; and decreased the following year by 7400 hectares. For the years 2005-06 to 2007-08, the actual irrigation potential reached has not been provided, but only the proposed potential. Therefore an assessment of developments over the last three years is not possible.

(iii) Minor Irrigation Department

As stated earlier, the MI Department provides annual data on target and achievements, and not cumulative data up to a particular year, and therefore its data cannot be taken into account for assessing the net irrigated area achieved from all sources cumulatively

Table 15. **Year-wise Status of Minor Irrigation in Uttarakhand**

S. No	Year	Deep Boring		Free Boring / Pumpsets		Weirs (No)		Artesian Wells		Gul (in Kms)		Hauz		Hydrams		Irrigation Potential Created (Ha)		Percent
		T	A	T	A	T	A	T	A	T	A	T	A	T	A			
1	2005 - 06	8	0	50	184	0	0	10	2	900.00	1760.81	200	636	36	101	6101.00	19529.52	320.10%
2	2006 - 07	0	0	50	264	4	0	10	7	3112.000	2238.701	1177	1209	45	39	20409.000	21563.733	106.00%
3	2007 - 08	0	0	0	232	2	2	10	4	2333.000	1174.074	900	1367	7	33	15000.000	12270.502	82.00%
<b>Total 2005 - 2008</b>		0	0	100	680	6	2	30	13	6345.000	5173.585	2277	3212	88	173	41510.000	53363.755	128.55%

Source – M I Report – 2004 - 2008

T: Target

A: Achieved

(iv) Minor Irrigation Census

From the table below, compiled from the MI Census of 2000-01, the figures 6.4 lakh ha and 4.8 lakh ha respectively seem to be gross potential created and utilized, as in net terms, the figures are far higher than the total net irrigated area for the state as a whole given in the Consolidated State Level Data , as well as far higher than the irrigated area achieved by the Irrigation Department, that includes large scale plains irrigation as well.

The State level consolidated data gives the Gross Irrigated Area from all sources as 5.49345 Lakh hectares, whereas the table below suggests that the Irrigation Potential Utilized [ gross irrigated area] from MI systems alone as 4.81145 Lakh Hectares, leaving 0.68200 Lakh hectares, or 68200 hectares as that irrigated by state medium canals.

Table 16. CCA, POTENTIAL CREATED AND UTILISED AS PER TYPES OF IRRIGATION SYSTEM

S.No	Type of Irrigation Systems	CCA	Potential Created	Potential Utilized	Percentage of Potential Utilized
1.	Dug Wells	7631	11936	10526	88 %
2.	Shallow Tubewells	155738	242778	184612	76 %
3.	Deep Tubewells	49237	76165	59388	77 %
4.	Surface Flow Systems	177018	296689	215130	72 %
5.	Surface Lift Systems	9743	15458	11489	74 %
6.	<b>Total</b>	<b>399367</b>	<b>643026</b>	<b>481145</b>	<b>74 %</b>

- 1 – Dug Wells – Data from 5 Districts only.
- 2 – Shallow Tubewells – Data from 5 Districts only.
- 3 – Deep Tubewells – Data from 6 Districts only.
- 4 – Surface Flow systems – Data from all 13 Districts.
- 5 – Surface Lift Systems – Data from all 13 Districts.

District –Wise CCA, Gross Potential Created and Utilized

The MI Census does not provide in a consolidated manner, information on potential created and utilized district wise, but rather does it on a system-wise basis, such as for dug wells, shallow wells, deep tube wells, flow systems and lift systems.

## Summary

In order to assess the overall irrigation status of Uttarakhand, at a minimum, the following data is required for any particular year.

- Different types of irrigations systems – district wise and State level.
- Their respective numbers – district wise and State level.
- CCA, Gross and Net Irrigated area under each type of system- district wise and state level.
- Season wise irrigation - systems wise.

From the review above, the following observations can be made.

1. Due to the fragmentation of the State's function in irrigation management under different departments, a totally uncoordinated system of data collection and maintenance prevails, due to which it is difficult to accurately assess the irrigation status of Uttarakhand as per the above minimum parameters.

The problems in the methodology of data maintenance currently are as follows.

- Using different parameters for different years, making comparison difficult.
- Using different parameters for different departments, making consolidation difficult.
- Issuing more than one set of data by a particular department for a specific year, but with different parameters
- Providing data on “gross irrigated area” and “net irrigated area” interchangeably for consecutive years, making it difficult to make assessments of annual progress.
- Using terms such as “CCA”, “Irrigation Potential”, “Irrigation Potential Achieved”, “Irrigation Potential Created” interchangeably or alternately, leading to confusion and inability to assess progress.
- Absence of distinction between various sources of irrigation clearly and consistently, while providing data on numbers and area irrigated.
- Not defining terms such as “Other Sources” and “State canals”.
- Not distinguishing between Terai and hill areas in provision of data.
- State level consolidated data does not reflect district wise scenario.
- Area under State and non-state irrigation systems – surface flow, surface lift, other storages, wells [shallow, dug, deep tube] etc. is not clearly and consistently provided.

2. Subject to the above inaccuracies and inconsistencies, the status of irrigation in Uttarakhand can be assessed as follows from a combination of the several sets of statistical data.

*Irrigation Infrastructure*

a.	Total No of M.I. Systems	No.	80053
b.	Total Length of Canals [Medium & Minor]	Kms	8328
c.	Total State Owned Surface Flow & Lift Systems	No.	5776
d.	Total Non-State Surface & Lift Flow Systems	No.	20458
e.	Total Dud, Shallow & Deep Tubewells	No.	53819

Note – Ownership data not available – predominantly Non-State.

*Area Irrigated*

*Data Set 1 [Department of Economics & Statistics]*

1.	Potential Irrigated Area under all systems [Gross]	2004-05	5.08 Lakh Ha
2.	Actual Irrigated Area under all systems [Gross]	2004-05	6.48 Lakh Ha

*Data Set 2 [Department of Economics & Statistics]*

3.	Net Irrigated Area under all systems	2006-07	3.45 Lakh Ha
4.	Gross Irrigated Area under all systems	2006-07	5.49 Lakh Ha

*Data Set 1*

5.	Potential Irrigated Area under all systems [Gross]	2006-07	5.33 Lakh Ha
6.	Actual Irrigated Area under all systems [Gross]	2006-07	6.97 Lakh Ha

*Data Set 2*

7.	CCA under State Canals [This may include medium and minor systems under ID and MID management]	2003-04	2.88 Lakh Ha
8.	Net Irrigated Area under State Canals	2003-04	Not Available

*Data Set 1*

9.	Potential Irrigated Area[Major/Medium] [Gross]	2006-07	3.220 Lakh Ha
10.	Actual Irrigated Area[Major/Medium] [Gross]	2006-07	3.720 Lakh Ha

*Data Set 3 [MI Census 2001]*

11.	Irrigation Potential Created under all MI systems [inconsistent with No. 2 above]	2000 - 01	6.43026 Lakh Ha
12.	Irrigation Potential Utilized under all MI systems [inconsistent with No. 1 above]	2006-07	4.81145 Lakh Ha

*Data Set 1*

13.	Irrigation Potential Created under MI [Gross]	2004 - 05	6.1642 Lakh Ha
14.	Irrigation Potential Achieved under MI [Gross]	2004 - 05	4.8245 Lakh Ha
15.	Irrigation Potential Created under MI [Gross]	2006-07	6.656 Lakh Ha
16.	Irrigation Potential Achieved under MI [Gross]	2006-07	4.963 Lakh Ha

3. District-wise status of irrigation.

In terms of irrigation infrastructure of all types, as well as CCA, gross potential created and utilized, the plains districts, particularly Udham Singh Nagar predominate. A few hill districts show appreciable levels of infrastructure, CCA and gross potential created. However, they fall off the list in terms of potential utilized. Districts such as Rudraprayag, Chamoli, Champawat feature consistently in the “low” category both in terms of infrastructure as wells as area irrigated.

## V Review of AIBP

### 5.1 AIBP Guidelines

The Government of India issued modified guidelines for AIBP in December 2006, the main features of which are presented below. The guidelines relate to the following aspects of the program.

- I. Eligibility Criteria for Funding – indicating the types of projects that are eligible for coverage.
- II. Terms of Funding and Mode of Disbursement
- III. Monitoring of Projects.

*I. Eligibility Criteria for Funding – indicating the types of projects that are eligible for coverage.*

1. Types of projects which are eligible.
  - Major, medium and Extension, Renovation & Modernization (ERM) irrigation projects (a) having investment clearance of Planning Commission (b) are in advanced stage of construction and can be completed in the next four financial year (c) are not receiving any other form of financial assistance can be considered for inclusion in the programme.
  - Components of the projects not receiving any other form of financial assistance
  - New project could be included in programme only on completion of an ongoing project under AIBP on one to one basis EXCEPT FOR projects benefiting (a) drought-prone areas; (b) tribal areas; (c) states with lower irrigation development as compared to national average<sup>19</sup> and (d) districts identified under the PM's package for agrarian distress districts.]
2. Surface minor irrigation (MI) schemes (both new as well as ongoing) of states of North-East, Hilly states (Himachal Pradesh, Sikkim, Jammu and Kashmir and Uttarakhand) and drought prone KBK districts of Orissa which are approved by State TAC / State Planning Department will be eligible for assistance provided that
  - (i) individual schemes are benefiting irrigation potential of at least 20 ha.
  - (ii) group of schemes (within a radius of 5 km) benefiting total ultimate irrigation potential of at least 50 ha.
  - (iii) proposed MI schemes have benefit cost ratio of more than 1 and
  - (iv) the development cost of these schemes per ha is less than Rs.1.00 lakh.

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<sup>19</sup> While the hill areas have below national-average irrigated areas, the state as a whole is above national average due to the intensive irrigation in plains districts.

## II. *Terms of Funding and Mode of Disbursement*

1. The central assistance will be in the form of central grant which will be 90% of project cost in case of special category States<sup>20</sup>, projects benefiting drought prone area, tribal area and flood prone area and 25% of project cost in case of Non-special category States<sup>21</sup>. The balance cost of the project as the state's share is to be arranged by the state government from its own resources.
2. During a financial year, the sanctioned grant will be released in two installments.
  - The first installment based on projected outlay
  - Second installment after confirmation of expenditure.
3. The grant component amounting to 90% of the total grant sanctioned will be released immediately and balance 10% will be released when 70% of the agreed expenditure is incurred.
4. Funding for the years subsequent to the first year will be based on the confirmation of expenditure of the previous years.
5. The grant component along with the state share must be released to the project authorities by the state governments within 15 days of its release by the Government of India.
6. State governments will be required to enter into an MoU with the MoWR for each individual project under the programme indicating balance cost, balance potential, year-wise phasing of expenditure vis-à-vis balance potential and agreement to create targeted irrigation potential in four financial years for major/medium projects and two financial years for minor irrigation schemes along with target date of completion.
7. In addition to above, for minor irrigation schemes in Non-special category states, the state government would give an undertaking (Annexure-IV) for their completion on schedule in two financial years and formation of Water Users Association for post construction maintenance.
8. Utilization Certificate must be submitted containing physical achievement of Irrigation Potential as agreed to in the MoU on year to year basis. In case, the physical achievements in a particular year are less than that agreed to in the MoU, further grant will be released only on achieving physical target. The final target date of completion will however not be changed from that entered into MoU.

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<sup>20</sup> The Special Category States covers the North Eastern States, Sikkim, Himachal Pradesh, Jammu & Kashmir, and Uttaranchal. The projects in the undivided Koraput, Bolangir and Kalahandi (KBK) districts of Orissa will also be treated at par with Special Category States.

<sup>21</sup> All other states not covered in special category are Non-Special Category States

9. If the State Governments fails to comply with the agreed date of completion, the grant component released will be treated as loan and recovered as per usual terms of recovery of the Central Loan.
10. The States are required to submit audited statements of expenditure incurred on the AIBP component of the project within nine months of the completion of the financial year.
11. The release of central assistance of the following years will not be considered if audited statement of expenditure is not furnished within nine months of release of central assistance.
12. The State Governments should confirm the project specific budget provision for work to be done under AIBP on year to year basis.

### *III. Monitoring of Projects.*

1. A comprehensive physical and financial periodical monitoring of major/medium projects will be carried out by Central Water Commission/Ministry of Water Resources and Ministry of Programme Implementation with emphasis on quality control.
2. The monitoring visit and submission of Status Reports will be carried out by the Central Water Commission at least twice a year for the period ending March and September of the year. The releases of subsequent installments will be based on physical and financial verification and the recommendations of Central Water Commission to the satisfaction of Ministry of Water Resources.
3. The latest techniques such as monitoring through Remote Sensing Technology may be used by the Govt. of India to monitor the progress of works specifically, the Irrigation Potential created and States are required to provide necessary input details of Project to the Central Govt. from time to time even after completion of Project.
4. Monitoring of the minor irrigation schemes has to be done by the State Government themselves through agencies independent of construction agencies.
5. Schemes would also be monitored periodically on sample basis by Central Water Commission and assessed against predetermined targets by the Ministry of Water Resources.

## 5.2 Concept and Objectives of AIBP- relevance to Uttarakhand

As stated in the beginning of this report, the concept of AIBP was mooted to meet the needs of the major and medium irrigation sector in the country, which, since the period before Independence to the present, has been plagued by huge inefficiencies and cost over runs, resulting in failure to achieve the irrigation potential created, or proposed to be created.

This problem certainly exists in Uttarakhand state as well, with respect to the medium irrigation systems, mostly in the plain areas- which are characterized by the problems similar to major and medium systems elsewhere in the country – non completion of distributory systems, lack of adequate drainage, inequity in water distribution, poor system maintenance, damaged structures, lack of farmer cooperation in management etc. However, on the whole, the state is not facing a situation of ‘incomplete’ or “ongoing” major or medium projects, the main issue addressed by AIBP. Rather, the need is to address management issues of completed medium projects, and the construction and extension of new minor irrigation projects which are the mainstay of the State’s agricultural sector.

With respect to works under Irrigation Department [major and medium], the AIBP guidelines prescribe that only ongoing, incomplete projects may be taken up, and new works can be undertaken only under certain conditions – i.e. projects benefiting (a) drought-prone areas; (b) tribal areas; (c) states with lower irrigation development as compared to national average; and (d) districts identified under the PM’s package for agrarian distress districts. These conditions do not apply to Uttarakhand. However, in the particular context of Uttarakhand, a hilly state, the Irrigation department has also been undertaking construction, operation and maintenance of minor irrigation works, and continues to do so. As such, both the Irrigation Department and the Minor Irrigation department have undertaken construction of new minor irrigation works in addition to additional works on old MI systems.

While the AIBP has been broadened to include minor irrigation as well, the question arises as to whether MI in a state such as Uttarakhand [and others like it] is perceived through the same lens as AIBP with respect to major and medium systems – that are usually ‘incomplete’ or ‘ongoing’. In the case of MI systems, eligible systems for AIBP are those which irrigate 20-50 Ha and cost less than Rs 1 lakh per hectare each. Such small projects should not, in the normal course of implementation, remain ‘unfinished’ in any particular year. By allowing ‘ongoing’ schemes in the minor irrigation sector, the AIBP is indirectly and inadvertently promoting inefficiency and tardiness in this sector as well, by forcing government agencies to identify unfinished or incomplete minor irrigation schemes for funding. Even in the case of medium schemes, there is a tendency to perpetually show ‘incomplete or unfinished schemes’ perpetually in need of

upgradation by the State. The AIBP guidelines do not provide for a planned way of completion of specific schemes or projects, so that they become ineligible for further funding.

### 5.3 Nature of Works taken up under AIBP in Uttarakhand [MI and ID]

The following types of works have been undertaken by the Irrigation and Minor Irrigation Departments under the AIBP in Uttarakhand.

<b>Irrigation Department</b>	<b>Minor Irrigation Department</b>
<ul style="list-style-type: none"> <li>○ Off Shoot Construction</li> <li>○ Gul Construction</li> <li>○ Shifting of Canals</li> <li>○ Lining of Canals</li> <li>○ Construction of Field Channels</li> <li>○ Lining of Field Channels</li> <li>○ Lining of Guls[traditional canals]</li> <li>○ Repair of Guls</li> <li>○ Construction of Bore Cut</li> </ul>	<ul style="list-style-type: none"> <li>○ Gul Construction</li> <li>○ Hydrant Construction</li> <li>○ Hauz Construction.</li> <li>○ Weir Construction</li> </ul>

The tables below show the numbers of different types of works taken up by ID and MI over the years. From the data of Irrigation department, it can be seen that ‘lining of canals’ is the type of work mostly taken up every year. The scheme-wise data does not indicate clearly whether old or new works are being taken up. It can be assumed, however, that ‘lining’ and ‘repair’ works and construction of field channels are ‘old’ schemes taken up while gul/canal constructions may be new works.

Table 17. Type & No. of Works covered under AIBP [Irrigation Department]  
during 2006 – 07 & 2007 – 08

<b>Type of Works</b>	<b>2002-03</b>	<b>2003-04</b>	<b>2004-05</b>	<b>2005-06</b>	<b>2006 – 07</b>	<b>2007 – 08</b>
1. Off Shoot Construction				2	2	10
2. Gul Construction			1	3	5	7
3. Gul repair and Lining	1	1		2		
4. Shifting of Canals					3	–
5. Lining of Canals	4	4		11	6	16
6. Construction of Field Channels						6
7. Construction of Canals	1	1	2	1		
8. Lining of Field Channels					–	9
9. Construction of Lift Schemes	1	1				
10. Construction of Bore Cut	1	1				
<b>Total</b>	<b>8</b>	<b>8</b>	<b>3</b>	<b>19</b>	<b>16</b>	<b>48</b>

Source – Irrigation Department, Government of Uttarakhand, Dehradun

In the case of Minor Irrigation Department, the various types of schemes are guls [traditional channels], hydrams, tanks [hauz], weir and pipelines [see Table below]. The unit for guls is in kilometers whereas the other works are reported in numbers. Hence it is not possible to compare by numbers alone, the type of system to which priority is being given. This can be done by assessing the budgetary expenditure on each type of system.

The scheme-wise data from MI department also does not indicate whether the schemes taken up are new or old – whether gul, hydram, hauz, weir, pipe. In this case, no assumptions can be made from the existing data, as can be done with ID data.

Table 18. Type & No. of Works covered under AIBP [Minor Irrigation Department] during 2003- 2007.

S. No	Year	Physical Progress				
		Gul (Kms)	Hydrams (No)	Hauz (No)	Weir (No)	Pipe (Mtr)
1	2003 – 2004	93.136	10	158	6	8200
2	2004 – 2005	668.618	0	141	0	200
3	2005 – 2006	1522.246	61	452	0	67916
4	2006 – 2007	2726.99	12	847	1	74221

#### **5.4 Budgetary Allocations and Expenditures.**

Three sets of data on budgetary allocations and expenditures are available from Irrigation Department for different years. The Outlays on AIBP for all the years reviewed – 2002—08 are not available in any one set of data. Different sets of data had to be referred to for the figures for that year. As such the data is not consistent. A difficulty arises also due to different terms used – Budgetary Provision, Budgetary Outlay, sanctioned Outlay etc. The MI Department also has two sets of reports. - one a printed and published Annual Report of the department and the other – a compiled set of data printed on data sheets. The figures on these two sets of data generally tally, except for the occasional use of differing terms. . For the following analysis, the printed and Annual Reports are relied upon.

Table 19. Budgetary Allocation under AIBP, District and State Plan for ID and MI

S. No	Year	AIBP [MI] [% of total MI Budget]	AIBP [ID] [% of Total ID Budget]	Total AIBP [% of Total State Irrigation Budget]	District Plan		Total District Plan	State Plan		Total State Plan	Grand Total
					ID	MI		ID	MI		
1.	2002 – 2003		290.00 [7.67%]	290.00 [7.67%]	1884.49		1884.49	1605.00		1605.00	3779.49
2.	2003 – 2004		300.00 [6.72%]	300.00 [6.72%]	2296.06		2296.06	1865.34		1865.34	4461.40
3.	2004 – 2005	5,298.91 [79.4%]	292.90* [8.1%]	5591.81 [54.5%]	2406.00	922.69	3328.69	880.00	451.08	1331.08	10251.58
4.	2005 – 2006	11,305.00 [87.5%]	300.00 [3.7%]	11605.00 [55.73%]	5322.00	1,000.00	6322.00	2351.00	604.00	2955.00	20882.00
5.	2006 – 2007	13,645.00 [88.5%]	466.00 [3.01%]	14111.00 [45.87%]	2945.09	543.35	3488.44	12038.91	1,121.90	13160.81	30760.25
6.	2007 – 2008	20,000.00 [82.1%]	4360.09 [17.89%]	24360.09 [59.97%]	3061.72	730.29	3792.01	11335.03	1,129.07	12464.10	40616.2
		50,248.91 [89.31%]	6008.99 [10.68%]	56257.90 [50.79%]	17915.36	3196.33	21111.69	30075.28	3306.05	33381.33	110750.92

The Table above presents data on the budgetary allocation for irrigation sector through AIBP relative to the State budget for the sector. It can be seen that the proportion of AIBP budget to the total irrigation budget has risen from 7.67% in 2002-03 to as high as 50.79 % in 2007-08. Details regarding the proportionate AIBP budget for the major/medium and the minor irrigation sector are also provided in the table above. From this it may be observed that the AIBP budget for the minor irrigation sector is on an average, as high as 89.3%. It is significantly higher than the major/medium sector, which is entirely appropriate for a hilly state such as Uttarakhand, where MI is far more prevalent.

From the above data, it is apparent that the AIBP is not just a significant contributor to the Irrigation sector budget in the State, but its very basis. As such it has a very significant role to play in the development and sustainability of irrigated agriculture and thereby the economic status of Uttarakhand.

### *Scheme –wise costs*

With respect to scheme wise costs, under Minor Irrigation, the only prescription under the AIBP is that the development cost of the schemes selected should be less than Rs 1 Lakh per Ha.

It is not possible to assess whether this norm has been followed or not in the implementation of AIBP in Uttarakhand, due to the lack of appropriate data.

- In the data provided by Irrigation Department, the estimated cost and expenditure of each scheme is provided. However, there is no data on CCA, Irrigation Potential Created or Achieved scheme wise for the minor irrigation works undertaken by it. The approximate potential *to be created* is provided only for medium schemes for a single year 2005-06.
- With respect to data from MI Department, scheme-wise CCA, estimated cost and expenditure scheme-wise is provided, but not Irrigation Potential Created or Achieved. While the CCA could be used to assess the development cost per Ha, a problem arises because the cost of the scheme is given sometimes single-scheme wise, and sometimes cumulatively [for X kms of guls] or several different systems together.

### *Expenditure on AIBP*

The two concerned agencies do not adopt an identical format for reporting outlays and expenditure on AIBP.

The Irrigation Department has three sets of data – printed report, computer generated reports and online data [web data]. All three data are presented differently. The terms for financial reporting used by ID are Estimates, Budgetary Provision, Budgetary Outlay, Sanction, and Expenditure. For a particular year, each set of data uses different terms so that it becomes difficult to summarize the actual outlay and expenditure for that year, comparing the three sets of data. Also, the figures in each set of data differ for different years, as different parameters are used.

With respect to the MI Department, again there are two different sets of data – one, a printed annual report for any particular year, and secondly a computer generated report for that year. In reporting Expenditure and Physical Progress as per the latter report, the Estimated Costs, Sanctioned Outlay, Budget Provision, Released Amount and Expenditure is provided, along with data on physical progress [See Annexure]. In the Printed Annual Reports, the terms used are Budgetary Provision, Outlay Provision, Sanctioned Outlay, Sanction Released, and Expenditure. These parameters are more or less the same.

Subject to the difficulties involved in interpreting these varied terms, the following picture has been constructed on the outlay and expenditure on AIBP by ID and MID.

Table 20. Year-wise Budgetary provision and Expenditure on Gul and Canal Construction under AIBP [Irrigation Department] (in Lakh Rs)

S.No	Year	Outlay	Expenditure [% of Outlay]
1	2002 – 03	290.00	40.00 [ 13.79]
2	2003 – 04	300.00	287.15 [95.71]
3	2004 – 05	NA	145.41 [ ]
4	2005 – 06	300.00	980.24 [326.74]
5	2006 – 07	466.00	1491.34 [ 320.03]
6	2007 – 08	4360.09	4354.29 [99.86]

Source – Irrigation Department, Dehradun <http://www.Uttarakhandirrigation.com/budget>,

In the above table, the percentages of expenditure to outlay are highly variable, which can be ascribed to the lack of clarity on actual budgets made available for the scheme to ID for each particular year.

Table 21. Year-wise Financial Outlay and Expenditure of MI Department under AIBP(Rs in Lakhs)

S. No	Year	AIBP Outlay	Expenditure of AIBP[% of Outlay]
1	2004 - 2005	5,298.91	5298.91 [ 100]
2	2005 – 2006	11,305.00	11305.00 [100]
3	2006 – 2007	13,645.00	13590.00 [99.59]
4	2007 – 2008	20,000.00	10468.00 [52.34]

The table above shows the outlay and expenditure for AIBP under MID, which shows an almost 100% expenditure for all the four years except the last, which is 52.34 %, the reason being that the programme covers two consecutive years, and the total expenditure will be made in the following year.

### **5.5 Irrigation Infrastructure Created and Irrigation Potential Created and Achieved under AIBP**

The following Table provides data on the infrastructure created under AIBP through the MI Department. As can be seen from the table, the CCA is mentioned, but there is no mention of Irrigation Potential Created or Achieved. It is not also clear whether the CCA is prior to the schemes being implemented or post-construction. The CCA, Irrigation Potential Created or Achieved is not shown as per the different types of infrastructure created.

The scheme wise data of the Department provides information on type of system, estimated costs and CCA.. Since scheme wise data relates to estimated costs, it may be assumed that CCA is the proposed CCA. However, there are no reports of post-construction phase, on the actual area irrigated under AIBP schemes. The Department reports on the irrigation potential created/achieved under all programs cumulatively by the Department, from which no assessment can be made on progress under AIBP.

Table 22. Year-wise Status of Minor Irrigation under AIBP

S. No	Year	CCA (In Ha)	Total No of Schemes	Physical Progress upto 2003-2004				
				Gul (Kms)	Hydrants (No)	Hauz (No)	Weir (No)	Pipe (Mtr)
1	2003 – 2004	9434.136	185	983.136	10	158	6	8200
2	2004 – 2005	15011.828	226	668.618	0	141	0	200
3	2005 – 2006	15110.33	226	1522.246	61	452	0	67916
4	2006 – 2007	34388.748	502	2726.99	12	847	1	74221
Total		<b>73945. 042</b>	<b>1139</b>	<b>5900. 99</b>	<b>83</b>	<b>1598</b>	<b>7</b>	<b>150537</b>

Source: MI Department

The physical progress under AIBP through Irrigation Department is shown in the table below. The total number of schemes is far below that of the MI Department, commensurate with the lower budgetary allocation to the ID.

Table 23. Physical Progress under AIBP [Irrigation Department] during 2002 – 03 to 2007 – 08

Type of Works	2002-03	2003-04	2004-05	2005-06	2006 – 07	2007 – 08
1. Off Shoot Construction				2	2	10
2. Gul Construction			1	3	5	7
3. Gul repair and Lining	1	1		2		
4. Shifting of Canals					3	–
5. Lining of Canals	4	4		11	6	16
6. Construction of Field Channels						6
7. Construction of Canals	1	1	2	1		
8. Lining of Field Channels					–	9
9. Construction of Lift Schemes	1	1				
10. Construction of Bore Cut	1	1				
Total	8	8	3	19	16	48

Source – Compiled from Various Reports of Irrigation Department, Government of Uttarakhand, Dehradun

Except for a single year – 2005-06, the Irrigation Department provides no data on Irrigation Potential Created and Achieved each year under AIBP. The Department reports on the progress achieved under all programs cumulatively by the Department, from which no assessment can be made on progress under AIBP. The data for the year 2005-06 is provided below. From this it can be seen that the *approximate irrigation potential to be created* is given, but there are no reports for that year on actual potential created or achieved. It can also be noted that both medium schemes and minor schemes may have been included [there is no actual indication], assuming that ‘guls’ are minor schemes. It is

also not known whether such guls are single schemes or 'clusters' of schemes, to assess whether the norm of 20-50Ha respectively are being followed.

Table 24. Sanctioned Schemes under AIBP in 2005 – 2006

S. No	Schemes	Cost of Schemes	Approx. Irrigation Potential to be Created (in Ha)
<b>Rudraprayag</b>			
1	3.50 kms Off-shoot in Jakholi & Agastyamuni Block	201.10	467
<i>Sub-Total</i>		<b>201.10</b>	<b>467</b>
<b>Udham Singh Nagar</b>			
1	Lining of Khatima Channels No 8, 9, 10 in Sitarganj Block	54.50	87
2	Lining of Nanakmatta Canal in Sitarganj Block	82.00	200
3	Lining of Navodiya Minor in Sitarganj Block	84.00	180
4	Lining of Bor Canal	33.40	36
5	Lining of Bhudiya Basgar and Doda Minor in Katna Canal	88.50	218
6	Lining of Lower Bhakhra Canal	33.00	34
7	Lining of Canal from Kagarsen Head Regulator	41.50	43
8	Lining of Haldi Terai Canal	54.00	60
9	Lining of Khajiya Canal	49.00	50
<i>Sub-Total</i>		<b>519.90</b>	<b>908</b>
<b>Nainital</b>			
1	Lining of Khichdi Canal in Ramnagar Block	65.68	102
2	Repair of 12 kms Guls in Upper Kota in Kotabagh Block	74.22	122
3	Construction of 2.5 kms Silsiya Gul in Kotabagh Block	28.15	66
4	Repair of 8.5 kms Gul in Kotabagh Block	73.46	84.06
5	Construction of 8.4 kms Gul in Okhal Kanda Block	46.00	48
6	Construction of 5 kms Gul in Bhimtal Block	24.05	29
<i>Sub-Total</i>		<b>311.56</b>	<b>451.06</b>
<b>Dehradun</b>			
1	Repair of Dudhli Bulandwala & Nangal Jwalapur Canal in Doiwala Block	343.30	795
2	Construction of 6.5 kms Canal on Wasan Pine in Kalsi Block	198.07	96
3	34 kms Off Shoot in Vikasnagar Block	177.30	404
<i>Sub-Total</i>		<b>718.67</b>	<b>1295</b>
<b>Uttarakhand Total</b>		<b>1751.23</b>	<b>3121.06</b>

## 5.6 Establishment of Farmers' organizations.

Table 25. No. of Water Users Organizations [WUA] created under AIBP since FY 2002

S. No	Year	Nos. of Schemes	Nos. of Sub-Schemes	No. of Farmer's Organizations Established
1	2002 – 2003 & 2003 – 2004	185	1077	1077
2	2004 – 2005 & 2005 – 2006	226	1907	1907
3	2005 – 2006 & 2006 – 2007	502	4284	4284
4	2007 – 2008 & 2008 – 2009	898	7866	7866
			Total	15134

Source – Office of the Chief Engineer, Hqrs, MI Department, Dehradun, Uttarakhand

The above data on constitution of Water Users' Organizations is provided by the MI department. No similar data is available from the Irrigation department. As per the above table, a total of 15134 Associations have been established so far. However, since there was no data available on district wise, scheme wise organizations, verification of the above data could not be made. The department has issues a set of guidelines for the constitution and functioning of WUAs.

## 5.6 Observations from Field Study

The field study was conducted in four districts of Uttarakhand viz. Almora and Bageshwar in Kumaon Region and Uttarkashi and Chamoli in Garhwal region. The objective was to assess the physical condition and sustainability of systems covered under the AIBP fund.

The following schemes covered by the ID and MI from 2003 – 2004 till 2006 – 2007 under the AIBP were selected randomly for field study.

S. No	District	2003 – 04	2005 – 06	2006 – 07	Total
1	Almora	1. Ranman Gul [MI] 2. Chopra Gul [MI]		1. Khatyadi Gul [MI]  2. Lining of 8 kms Field Gul in Lamgara Block [ID]  3. Lining of 7.625 kms Field Gul in Lamgara Block [ID]	5
2	Uttarkashi	1. Math Purola [MI] 2. Mori Nanai [MI]	1. Purola II [MI]		3
3.	Chamoli	1. Dewal [MI] 2. Meeng [MI]	1. Narainbagar [MI]	1. Kharani Tok Timala [MI]	4
4.	Bageshwar			1. Lining of 19.50kms Gul in Bageshwar [ID]  2. Lining of 14.9 kms Field Gul in Kapkote Block [ID]	2
<b>Total</b>		<b>6</b>	<b>2</b>	<b>6</b>	<b>14</b>

The study covered the following aspects to get a broader picture of the state of AIBP in Uttarakhand –

- Planning and implementation processes. Involvement of local communities and elected bodies in implementation and management
- Irrigation potential created and achieved.
- Water conservation, source protection.
- Efficient dispute resolution.
- Financial sustainability.
- Role of Panchayat Institutions

*Planning, Implementation and Management processes -Involvement of local communities and elected bodies.*

In all the schemes surveyed, the farmers [both men and women] were of the opinion that the planning of the scheme and its implementation is entirely in the hands of the concerned department. The farmers were not involved in any systematic manner. In seven of the villages, it was found that only the Gram Pradhan had some information about the proposed works to be undertaken. This information had not been shared with the other villagers. In none of the schemes were the villagers aware of the AIBP as a specific scheme. In four of the schemes, the villagers had earlier submitted applications to the department for assistance in repairing damages to the channels. However, they were unsure whether the current works by the department were in response to their requests. The farmers interviewed were unsure as to how and when the estimates for the works were made, and when they were sanctioned. They were differing perceptions on the amount of investment made by the Department on the guls. None of the villages surveyed had any knowledge of Farmers' Associations being formed.

The ID schemes were fully managed by the department, and the villagers had no role in it. The farmers were of the opinion that the guls should be handed over to the Gram Sabha as is being done by the MI Department, but along with funds for repair and maintenance.

Farmers are not given any notice of the implementation procedures. In ID and MI Schemes, contractors are involved in the construction and repair works. These contractors are not procedurally bound to involve the local people in implementation.

With respect to ID schemes, a system operator is generally appointed by the government for operating and maintaining the system, distributing the water and in most cases, for collecting the water tariffs. The functions of the operator include operating the system, distribution of water, repair and maintenance in some cases, and collecting water tariffs in most cases. It was observed during field study that there was no uniform pattern of distribution of water. This gave rise to differences in patterns of water distribution within villages, and had an adverse impact on equitable access. In many cases, the water

distribution within and between the villages was done by the farmers themselves, as the agency had failed to establish and maintain a distribution regime.

In MI schemes, the villagers were managing the guls themselves, but felt the need for state support in terms of financial assistance. This problem was particularly faced by women, as to due the migration of men folk, they had to engage labourers to undertake repairs to the guls, which used to be done traditionally by the men folk themselves.

In all villages, it was reported that the repair and maintenance of the system by government agencies was very poor, taking several months to restore parts that had broken down. In most villages, it was reported that the repair and maintenance of the system was done on a contractual basis, through private contractors, while in some villages, the farmers were investing their own funds for timely repair and maintenance. Since many villages had other traditional guls as well, in addition to State constructed systems, farmers were able to extend their skills and other resources to operate state systems as well, as much as was possible, depending on the overall physical status of the system.

#### *Irrigation potential created and achieved.*

This aspect is at the core of the AIBP, which is aimed at the 'completion' of projects, in terms of achieving the irrigation potential created. It is imperative therefore that data exists on the CCA and Irrigation Potential Created and Achieved on a system-wise basis. With respect to the systems under review, it was observed that the concerned agencies have maintained only partial data on this issue. Of the 14 schemes, only 10 schemes [MI] have recorded CCA. No assessment could be made on the potential achieved for the remaining schemes [belonging to ID]. The potential created in the 10 schemes varies between 10 to 18 percent of the recorded CCA. The remaining schemes implemented by the ID are 'repair schemes' and therefore the works undertaken did not contribute any additional potential.

#### *Water conservation, source protection.*

Before implementation of any irrigation schemes, water conservation and source protection should be the primary task of any water related departments, whether in the hill or the plain areas, due to an all round decline in surface and ground water availability. In all the 14 schemes, conservation and source protection measures were not adopted. Due to water depletion at the source and leakages observed at several places, the potential created could not be achieved.

### *Dispute resolution*

In the irrigation context, disputes arise mostly in relation to access to water, whether within a system or between systems which share the same source- i.e. stream from which the guls or canals are constructed.

In all systems surveyed, inequity in access to irrigation water is a distinct characteristic. Firstly, uneven land distribution among farmers – higher castes have 20 -30 nalis while lower castes have 2-5 nalis in the hill context – results in inequitable water rights. Secondly, the poor functional status of a majority of the systems has logically an adverse impact on equitable distribution of water. Failure of the distribution system unevenly across the system due to system damages and partial lining of channels in different parts are a major reason for inequitable access to water. The fact of large differences between the potential created and actually achieved is a pointer to inequity in access to irrigation water.

Discussions with the farmers revealed that there are no initiatives by irrigation agencies for the resolution of disputes that arise due to inequitable distribution of water. In MI schemes, the farmers themselves manage their own disputes. However, in many cases, due to system damages which are not attended to promptly, the problem persists and cannot be solved easily. In ID schemes, farmers with a better access to the beldars [government appointed system operators] take advantage in ensuring their own water supplies. Repair works on leakages are done selectively, benefiting some and ignoring others.

Inter-village disputes are also prevalent, for which there are no mechanisms for redressal. Thus, dispute resolution is an important aspect of management that is not addressed by the irrigation policy in general, including the AIBP.

### *Financial Sustainability*

That this critical aspect of management is not addressed at all under the AIBP is apparent from the study. From discussions with the farmers and from field observations, it was found that irrigation systems in which the State agencies have been involved are in a perpetual state of disrepair, in contrast to the traditional farmer-owned systems. This situation is primarily due to the fact that farmers have traditionally utilized locally available materials such as stones and mud to construct guls, which can be replaced without cost, whenever needed. It has to be noted that in the hill context, damages to irrigation systems are frequent and regular, due to soil erosion, flooding, and land slips. The use of cement in the construction and lining of guls by state agencies have taken the systems beyond the capacity of local people to repair and maintain. The handing over of schemes by the MI department to local communities without any funding assistance for repair and maintenance has placed a burden on them beyond their means. Farmers

continue to look to the State agencies for support, even while they continue to manage their traditional systems themselves. In the case of ID systems, the management being with the department, the issues of sustainability is the concern of that department.

With respect to water tariffs, there is no uniform policy at the state level. The ID collects tariffs from its systems, whereas the MI does not do so, as technically, they hand over the systems to local communities after construction. The basis of determination of tariffs and mode of collection of the tariffs differs in the hills and plains. It was based either on use of water either on hourly or daily basis, or on the basis of acreage irrigated. The tariff was collected either by the operator, or by the revenue department. The tariff under ID systems in the hills is Rs 40 per hectare per crop. There is no functional relationship between the extent of tariff levied and the costs of maintaining the system. In traditional systems managed by the villagers themselves, farmers provide free labour or cash or contribution in kind as their share of costs of maintaining the system.

#### *Role of Panchayat Institutions*

The 73rd Constitutional Amendment on PRIs includes minor irrigation in the list of subjects in the 11<sup>th</sup> Schedule, the functions in relation to which are to be transferred to these bodies. However, in spite of the claims of the ID and the MI department, the Panchayat Institutions in the surveyed villages have no role in the management of irrigation. There is no defined role for PRIs in any of the systems surveyed.

#### *Summary of Opinions and Expectations of Farmers in surveyed villages and observations made in the field.*

The following opinions and expectations were expressed by farmers in the surveyed villages in the course of discussions.

- The local community should be given management powers over state constructed systems. Community management of single village as well as multi-village systems are entirely feasible, as they have existed in the past, and still exist in many places.
- The expenses of maintaining and repairing community systems are met by the villagers themselves. The functions that are undertaken by the villagers include construction, repair, maintenance, distribution of water, mobilization of resources for all these tasks, and dispute settlement.
- Community managed irrigation systems are generally fully functional, as long as there is no disturbance in the source or command areas, due to state intervention. However, if there is extensive environmental degradation, due to natural causes, farmers do not have the wherewithal to repair systems on their own.

- The distribution of water is generally equitable as it done on the basis of consensus on the pattern of distribution. Variation in distribution is adopted to suit the needs of the particular crop or to maintain equity in water distribution. In distribution of water, farmers are sensitive to the particular needs of individual farmers and take their personal problems into account in varying the distribution pattern.
- Where government constructed systems are present, in the event of failure by government agencies in operation, repair or maintenance, farmers are able to take over and run the systems as much as the water availability permits. If the water source is itself affected, or extensive damages occur, farmers are helpless and suffer the consequences of loss of irrigation.
- Farmers have set up a system for dispute resolution, should disputes arise. However in most cases, there are very few disputes in traditional systems.
- No initiatives are taken by the villagers themselves to address the general environmental deterioration that results in a reduction of water availability in the sources.
- Community irrigation systems are constructed to serve multiple purposes – irrigation, running of water mills, watering cattle, as a resource for village artisans.
- Government intervention in traditional irrigation systems results in utter failure. Traditional systems which had been previously well managed and functional, invariably deteriorate over time under Government management.
- Traditional systems have been and are being taken over by Government without proper justification; usually the proposal is for partial lining of channels, and extension of system to more villages, on the pretext of which the system take over happens. The State agency does not undertake any work for increasing water availability from source. Rarely is there a substantial increase in CCA as a result of Government takeover.
- State constructed systems are generally non-functional or partially functional, as a result of poor design in relation to local topographic and environmental conditions. In the 14 systems reviewed, the performance is less than 25% in terms of the actual area irrigated.
- The performance of system operator appointed by the Irrigation Department is generally reported to be very poor and in many cases, the villagers continue their own water distribution system. Also, Government appoints an insufficient number of operators for large systems, as a result of which the villagers have to take over

the responsibility even though the State Agency is spending funds for the salaries and administrative expenses of the system operators. The fact that operators are appointed for some villages and not for others, results in varying patterns of distribution of water within the different villages, impacting on equity.

- Funds allocated by the Department for the repair and maintenance of the irrigation system are either not spent at all on the system, or incompletely spent. As a result, the systems deteriorate and leakage occurs in many places.
- No initiatives are taken by the state agencies to address the general environmental deterioration that results in a reduction of water availability in the sources.
- A common complaint of farmers irrigating under state systems is with regard to lack of information about the funds for the project – how much it is sanctioned, how it is spent. Due to this lack of information, farmers have the belief that the allocated fund is insufficient for the system, or that not all the allocated money is actually spent on the system.
- There is no uniformity in the pattern of distribution of water in state managed system. However there are no logical explanations for the variation, and depends on the whim and fancy of the system operator, who is influenced by the stronger farmers in the village.
- There is no uniformity in determination of water tariffs.

*Impact of other sectoral policies on Irrigation.*

- The expansion of urbanization affects villages which have been notified in such urban areas, or those which are in the vicinity. This is mainly due to administrative changes due to which the support hitherto received from state agencies is withdrawn. There is no provision under urban administrative systems to address agriculture and irrigation that may continue to be practiced in urban notified areas.
- Since the provision of drinking water has been made a priority, State Drinking Water agencies withdraw water from sources unilaterally, without any reference to irrigation that may be occurring from such sources. There is a direct impact on irrigation for which there are no compensatory programs or activities. There is also no consultation with affected people. As a result, after such drinking water systems are built, irrigators frequently resort to theft of water to meet their needs, or they damage the systems that are affecting them adversely.

- Compulsory land acquisition by Government for various purposes adversely affects cultivated / irrigated land. Protests by people make no difference to the situation. A major reason is that in policy, agriculture and irrigation have not been given a priority over other sectors in land use.
- Illegal and unregulated construction activities lead to encroachment on link channels.
- Construction of roads, repair of highways, construction of paths – all resulted in damages to the systems by falling debris, for which there were no remedies.

## **VI. CONCLUSIONS AND RECOMMENDATIONS**

The Central Government-sponsored Accelerated Irrigation Benefit Program is an important program to the irrigation and thereby agricultural sector – the mainstay of the economy of Uttarakhand. In reviewing the AIBP in this state, the main question to be addressed is -how effectively is the state irrigation and agricultural policy effectively reflect the needs, conditions and aspirations of the predominantly rural population of the state with its unique physical, environmental, social and economic characteristics, and how effectively is AIBP a part of the state irrigation and agricultural strategy supporting this sector in the State.

The importance of agriculture in this predominantly hilly state has been discussed in previous chapters. A significant feature is the physically smaller plains area [only 20% of the total geographical area of the state] comprising 3 districts, but which is economically dominant in terms of irrigated agriculture and industry. On the other hand is the physically and demographically larger hill area, with traditional irrigation and agricultural practices, in dire need of development and progress, but handicapped by difficult physical conditions and serious degradation of natural resources. In addition to these two broad categories, the state can be further sub-divided into four sub regions in the hilly part, while the plains area consists of two distinct zones.

Given these conditions, it stands to reason that a different approach to agriculture and irrigation development needs to be adopted for these two broad categories with scope for sub-regional differentiation as well, while at the same time, adopting a holistic approach to the State as a whole. It is to be expected that the agriculture and irrigation policy of the State would be based on such an approach, where by financial investments would support appropriate technological and management regimes that are location specific.

The long traditions of agriculture and irrigation in the hill region do reveal such a response to local conditions. Irrigation technologies in the different regions are suited to local climatic and topographical conditions. So also, are land management and agricultural practices that include terracing of fields, dispersion of holdings, crop diversity and ownership patterns. Importantly, there is an integrated resource management approach to agriculture that includes a judicious use of land, forest and water resources for agriculture and animal husbandry. Agriculturists are dependent on forests for leaf manure for the fields, timber for agricultural implements, grasses and bamboo for many items used in daily agricultural life, fodder and grass for cattle, bamboo, and many Non Timber Forest Products for secondary occupations.

In the plains areas, wells are the an important source of irrigation, and the ground water levels in this region are directly dependent on the effectiveness of natural resources conservation and management in the hills. Surface irrigation in the plains is an extension of the State initiated large scale irrigation systems of northern India.

In the plains, agriculture is resource intensive in terms of use of water, modern agricultural technology, chemical fertilizers and pesticides and electric power and follows a market economy, while in the hills, it is mostly subsistence oriented.

Due to the failure of adopting a region specific agriculture and irrigation development approach over the last several decades since Independence in this region, there exists a significant amount of regional imbalances and disparity in terms of level of agricultural development among the districts of Uttarakhand. The hill districts have comparatively low productivity in food grains and other crops.

Another aspect which is an important part of the context in which AIBP is implemented is the degradation of natural resources. There has been an overall deterioration of the natural resource base. While land under 'open forests' may be increasing due to afforestation efforts that under dense forests is not; in fact, forests are becoming less dense. About 5143 sq. km. of forest land is badly degraded and denuded and demands urgent attention. The reduction in density of forests is primarily the cause of soil erosion and its consequent impact on water resources. There has been an overall decline in all water sources – glaciers, lakes, river flows, and springs. Land resources are in no better condition. The State of the Environment report for Uttarakhand states that with its fragile eco-system and geo-dynamic terrain, the state is highly vulnerable to earthquakes, landslides, forest fires, cloud bursts, etc. The state also faces serious threats from numerous man-made hazards such as massive deforestation, encroachment of unstable slopes for settlement and agriculture, ill planned and unscientifically implemented developmental schemes and projects.

An Irrigation policy of the State therefore has perforce to take note of these conditions. However, the official approach to irrigation administration has been a blind import of plains policy from the erstwhile parent state of Uttar Pradesh, with institutional structures, objectives and functions and operational procedures no different from that of the plains.

For instance, the entire irrigation agency apparatus is modeled on the "major / medium / minor irrigation" categories, which is based on the nature of *State* intervention in the irrigation sector. This is inappropriate in a state in which *private* irrigation constitutes the dominant mode of irrigation in both the hill and plains area. There are no 'major' irrigation schemes in the region and only a handful of medium schemes. With this exception, all irrigation systems are of the so-called "minor" category. Small scale systems are the predominant mode of irrigation in Uttarakhand as they are suited to the terrain. But the nomenclature "minor" continues to be applied to them, instead of recognizing them as the major mode of irrigation. As per prevailing state norms, "minor" 'irrigation refers to irrigation commands up to 2000 hectares. However, the average size of commands in hill irrigation systems is as low as 2-4 ha, and 5-100 ha in the plains. These systems are better described as 'micro-systems', requiring a different approach to management than that which has been promoted by the state agencies hitherto.

Secondly, given the fragile and rapidly degrading natural resource base, an integrated resource conservation, use and management approach is a basic minimum for the development of irrigated agriculture. The lack of an appropriate and dynamic agricultural policy in the shape of active State support for the development of agriculture in the region since Independence has resulted in the decrease in its economic and ecological sustainability, paving the way for massive migration of upto 60 – 70% of the male work force. This has further exacerbated the condition of the female work force already over – burdened with farm tasks.

The prevailing poor status of irrigation management by the State sector is a matter of serious concern, exemplified by the nature of the official data base on irrigation. Due to the fragmentation of the State's function in irrigation management under different departments, a totally uncoordinated system of data collection and maintenance prevails, due to which it is almost impossible to assess the irrigation status of Uttarakhand accurately, in terms of both the irrigation infrastructure as well as the area irrigated. There is a multiplicity of sources of data which do not correspond with each other. The parameters for data collection are narrow and inadequate and do not reflect the actual situation on the ground.

Due to conventional un-integrated and poorly coordinated governance mechanisms, the irrigation and agricultural departments do not take account of each other and function independently. The irrigation sector also does not coordinate with other water sector agencies, particularly drinking water sector agencies, even though the same sources are under demand for agriculture, domestic and commercial /industrial uses.

Neither the Irrigation agencies, nor Agriculture or Drinking Water Departments or Agencies have any functional relationship with the land management agency [Revenue Department] or the Forest Department, both of which are critical for the management of land and forest resources that sustain the water resources of the state. Needless to say, these agencies also follow outdated, isolated approaches to resource management.

It is in this overall context that the AIBP is being implemented.

The AIBP contributes a very high level of resources to the irrigation sector in the state. It is intended to bridge the gap between the irrigation potential created and achieved. In order to do this, the program needs to address all the relevant issues that contribute to a reduction of efficiency in irrigation [that prevent the full achievement of potential created], in addition to creating new, additional irrigated areas.

Rather than thus charting a new path to irrigation development, the AIBP currently constitutes an integral part of the same inefficient institutional mechanisms that have been responsible for the present problems that beset the sector.

The AIBP guidelines issued by the Government of India do not adopt a state-specific approach, nor do they provide the States an opportunity to develop their own operational guidelines for the implementation of the program.

The GOI AIBP guidelines have the following lacunae in the context of the implementation of AIBP in Uttarakhand.

1. The eligibility criteria for new and ongoing schemes for Uttarakhand [as for other hilly states] are mentioned as 20 ha for individual schemes, and 50 Ha for groups of schemes. The upper limit for individual schemes is too high, as in the hill areas, such schemes can irrigate only very small commands of less than 5 Ha. The upper limit for groups of schemes is also unsuitable; as such schemes may irrigate far less areas, and are nonetheless very critical. It has to be kept in mind that landholdings particularly in the hill areas are very low. Secondly, due to the peculiar topographical features and the dispersed availability of water sources, schemes may benefit only very small groups of farmers. In single villages, in innumerable cases, several irrigation systems may be required to bring the total cultivated area in a village under irrigation. The state Government should be given the freedom to develop its own operational guidelines that suit the hill and plains areas respectively.
2. The guidelines assume that the schemes are state-constructed schemes that need completion or are to be undertaken anew. This assumption does not fit the ground reality in the state, as the major part of irrigated area is under private irrigation. Therefore, the scheme should include the extension of financial assistance to farmers for the upkeep of existing systems as well as undertaking new ones.
3. The norm for development cost of the system is given as Rs 1.00 Lakh per Ha. However, given the difficult conditions in the hill areas of the State, this amount may be insufficient, particularly if an integrated natural resource approach is to be adopted for sustaining water supplies.
4. The guidelines do not contain any directions for an integrated, holistic approach to natural resources management, with an emphasis on water resource augmentation and conservation and instead follows the old, outdated approach of treating water resources as a stable, unlimited resource.
5. For medium irrigation schemes and extension, renovation and modernization projects, a period of four years has been given for completion. In Uttarakhand, there are no incomplete medium schemes, For REM schemes, the period of four years is too long, and the works should be completed in a shorter time.

6. The formation of Farmer's Organization is stipulated in the guidelines only for Non-Special category States, for minor irrigation schemes. Uttarakhand being a Special Category State, is not bound to constitute these organizations, even though the state has done so on its own initiative. These organizations are mentioned only in the context of minor schemes, whereas they are essential for the management of medium schemes in the State. As a result of this lacuna, the ID has not taken any steps for Farmers' User Groups [FUGs], whereas the MI has done so.
7. For monitoring purposes, the guidelines stipulate only physical and financial reporting, neglecting socio-economic, institutional and environmental parameters. As such, not even the basic agricultural data such as cropping patterns and yields are available with the irrigation agencies.

Most of the lacunae in the implementation of AIBP in Uttarakhand arise from the lack of state –specific, and more holistic guidelines from the Government of India on AIBP.

The program in its present form does not provide any incentive to improve the management of the irrigation sector as a whole in the state, which is characterized by inefficiency and lack of accountability. The status of official statistics in the irrigation sector as a whole requires much improvement, so also the data base on AIBP. Given the present status of the data, it is not possible to accurately assess the progress achieved through the expenditure of the vast financial investments being made through the program. Field studies show that there are serious shortcomings in the achievement of the irrigation potential created. There is no data to show how much new potential has been created, as there is no information available on this issue.

## RECOMMENDATIONS

Based on the above study, the following recommendations are submitted.

- The State should be allowed to develop its own operational guidelines for AIBP, with some broad principles laid down in the Central Guidelines
- An appropriate policy for the irrigation sector – a sub-sector of water resources – needs to be developed, in the context of which the AIBP should be implemented. The Draft Water Policy of Uttarakhand 2003 does not address the needs of this sub-sector adequately.
- There has to be integrated approach to agriculture and irrigation. Currently, the two sectors function entirely independently of each other in a manner entirely contradictory to the dictates of common sense and sound policy. This lapse is reflected in the AIBP as well.
- Environmental sustainability through integrated resource management approach needs to be a first concern for sustainability of the irrigation sector. The high levels of State investment as well as the higher investments from the farming community on a continuous basis are rendered a colossal waste if water availability is adversely affected or systems are damaged due to avoidable environmentally damaging actions. A major segment of AIP should be utilized for developing and conserving water and land resources through a watershed approach.
- There is a need to develop policy objectives and strategies for AIBP and for the irrigation and agriculture sector independently for the hill and Terai regions as they require different approaches altogether.
- A complete overhaul of the data base on the irrigation sector is urgently required. A comprehensive perspective that includes technological, socio-economic, institutional and legal dimensions needs to be adopted in developing a framework for the establishment of a data base. The preparation of the data base needs to be done through participatory processes, involving local communities and Panchayat institutions. Planning for the sector needs to be based on such a new data base, as the current statistical information is wholly inadequate for such a purpose. The AIBP should include a component for establishing a Management Information System.

- Irrigation planning should be linked to achieving food security. A district based perspective planning for agriculture and irrigation needs to be conducted, and the AIBP has to be an integral part of such planning, rather than being implemented in 'project' mode. The objective of such planning has to be the achievement of food security at district level through optimum production of diverse food crops through dispersed growth rather than perceiving the plains as the "grain bowl" of Uttarakhand. The irrigation sector has thus to support each district plan equitably.
- The achievement of food security in all districts of the State should be declared as the primary goal, rather than promoting market oriented agriculture that would benefit only a section of the farming community.
- A new irrigation policy of the state has to recognize the central role of the farming community in the development and protection of irrigation resources, and eschew the tendency of viewing this function as a unilateral state activity. In tandem with this new perspective, appropriate institutional frameworks for irrigation management need to be developed, according the primary role of control and management to community based institutions and Panchayat Raj Institutions. PRIs should be recognized as the first government agency for regulatory functions. The policy should include strategies for the strengthening of CBOs and PRIs for this purpose. The AIBP should be utilized to implement such a policy.
- An appropriate fiscal policy for the sector needs to be developed in tandem with the decentralization of control and management of irrigation, that is to be applied to AIBP as well. .
- A comprehensive review needs to be undertaken of the impact of other sectoral developments on irrigation resources and appropriate compensatory policies and strategies adopted to protect such resources.
- A review of the legal framework on water and land resources in relation to irrigation needs to be conducted in order to undertake appropriate legal reforms for strengthening the rights and authority of the farming community, Panchayat institutions and state agencies for the development and protection of land and water resources for irrigated agriculture.

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