HELVETAS Swiss Intercooperation | PAKISTAN

RICE PARTNERS

CROP PER DROP: WATER USE MASTER PLAN MURIDKE

2017-2019

Joyianwala: Munawar Khan Khattak

Joyianwala Main

2016

MARS food

PMIU

ON FARM WATER MANAGEMENT
Directorate General Agriculture

Credentials

Schweizerische Eidgenossenschaft
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This document has been through bilateral and collective consultation process with all partners including RPL, Punjab Irrigation Monitoring Unit and On Farm Water Management department Punjab.

Contents

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The Authors

Abbreviations

AWD	Alternative Wet Drying
CBM	Confidence Building Measures
DSR	Direct Seeded Rice
DPR	Delivery Performance Ratio
FGD	Focus Group Discussion
GIS	Geographical Information System
HBL	Habib Bank Limited
IC	Intercooperation
IMIS	Irrigation Management Information System
IPM	Integrated Pest Management
IRRI	International Rice Research institute
LBDC	Lower Bari Doab Canal
LCC	Lower Chenab Canal
LJC	Lower Jhelum Canal
MAF	Million Acre Feet
OFWM	On Farm Water Management
PMIU	Punjab Monitoring and information Unit
OPPM	Optimum Plant Population Management
PITB	Punjab Information Technology Board
PKR	Pakistani Rupees
PMD	Pakistan Meteorological Department
RCT BMP	Resource Conservation Technology Best Management Practices
RPL	Rice Partner Limited
REAP	Rice Export Association of Pakistan
RTFM	Real Time Flow Monitoring
RRI, KK	Rice Research Institute Kala Shah Kaku
SDC	Swiss Agency for Development and Cooperation
UC	Union Council
UBL	United Bank Limited
WAPRO	Water Productivity Project (Water Efficiency in Rice and Cotton)
WRMIS	Water Resource Management Information System
ZTBL	Zari Tariqaiti Bank Limited

Summary of the plan

This Water Use Master Plan (WUMP) is for the areas of Joyianwala Minor (branch of a canal), District Muridke. The main objectives of this plan is to provide a *Systematic ground for water stewardship in rice value chains to acquire water efficient and sustainable rice production model with multi-stakeholders and build a case for future up-scaling.*

This plan is focused on improving water use efficiency of rice farmers by promoting water efficient techniques, better agronomic practices and taking experiences to a higher scale to contribute to policy dimensions of water and rice through the coordinated efforts of all concerned stakeholders including private and public sector partners. The plan is based on rich experiences of applying Integrated Water Resource Management approach (IWRM) in SDC funded Water for Livelihoods (W4L) Project in Pakistan implemented by HELVETAS Swiss Intercooperation. WUMP priorities align with the core principles of water stewardship[1] namely equitable and transparent water governance, sustainable water balance and water quality.

The geographical scope of the plan is Joyianwala minor – which comprises 7 revenue villages, having a population of around 35000 in 7000 households. There are about 3000 farmers who mostly follow the cropping system of wheat-rice –fodder.

The current plan is an outcomes of a number of consultative workshops, individual and focus group discussions with concerned stakeholders at operational, service provisions and policy and regulatory levels of the rice value chains. The key stakeholders included farming communities of the project areas, public sector institutions (Irrigation Department, On Farm Water Management, Rice research institutes and local revenue officer) and private sector actors (MARS, RPL, Reap representatives). These actors have provided their sincere inputs, insight and know-how to elaborate this plan.

Main water issues identified:

The following problems related to water productivity are prevalent in the Muridke, District Sheikhupura:

- The existing water sources (water from canal and rainfall) do not generate adequate water for irrigation purposes (at mid and tail end).
- The farmers supplement their irrigation requirements by excessive pumping of groundwater supplied through the tube wells. The cost of extraction is much higher than the canal water for irrigation.
- Over exploitation and mining of poor quality groundwater results in soil degradation and degradation of groundwater table.
- Quality of drinking water at shallow depth of (15-30 m) is poor and has become the cause of diseases including diarrhea, scabies, allergies, goitre and kidney infections.
- Canal water theft from irrigation minor is a chronic issue at the beginning of Kharif season by the upstream farmers and thus the equitable distribution of water for irrigation purpose becomes difficult. Farmers at mid-stream and tail receive less irrigation water.
- The channels are also mainly earthen, vulnerable and need continuous maintenance. This lead to the considerable water losses ranging from 25 to 30% from canal to farm gate. These are conservative assessments in absence of any gauged monitoring system available during peak season water requirement (responsibility of Irrigation department).

[1] http://www.allianceforwaterstewardship.org/assets/documents/AWS_Standard_First_Draft_v_03_13_2012.pdf

- The rotation (locally called *warabandi*) system is fixed among farmers (discharge, frequency and intensity) and functions in a strict manner without being changed.
- There are no farmer's associations in the areas for safeguarding proper water use or to dialogue with authorities. The warabandi system was fixed at the time of canal establishment decade's back when the cropping intensity was 67%, while now the cropping intensity is about 150% (despite legally it is still supposed to be 67%) and water is never enough to meet this requirement.
- The on-farm technology and agronomic practices related to high water use efficiency need to be proven, replicated and up scaled. There are apprehensions among farmers on applying these techniques.
- Enforcement of laws is weak, non-transparent and involves a long hierarchy.

The following major areas of interventions have been identified for the WUMP after a thorough consultative process to promote water efficiency in rice value chain:

1. **Improved water governance:** Improved govenrnace of water relates to improved stewarding of water thorugh collective action. The project area has not been fortunate in terms of collectivism. Institutional erosion, inequitable access to water, lack of accountability and transparency, limited culture of community participation, lack of faith among farmers in forming associations and weak enforcement of laws have been some of the main factors for poor water governance. In order to promote improved water governance it is suggested to motivate farmers to form Water Users' Associations[2] and register them. These associations in the beginning may only comprise contract farmers of RPL and their capacity may be built to make them into good institutions, have backward and forward linkages, access to information on good agronomic practices and to make them aware of climate and other forms of stresses on water that are essential to take into account. These associations may also begin to save some money collectively functioning of their associations but once trust is built among farmers on usefulness of such associations.
2. **Maintaining sustainable water balance:** Activities under this intervention are mostly related to practically attaining water productivity using various techniques and technologies. These include the use of laser levelling[3], Direct Seeding of Rice (DSR) and more traditional methods such as use of water efficient rice varieties and optimizing water depth or number of irrigations. It is estimated that laser levelling reduces about 20 to 30% water intake for the same agronomic practices in rice, DSR about 15% and 20% by use of water efficient varieties. The application of alternate wetting and drying method (AWD) is also recommended which contribute about 15% saving of water (controlled irrigation). Overall 35% water can be conveniently saved if integrated measures are adopted by rice growers.
3. **Water policy advocacy and regulatory areas:** This set of interventions are concerned with best practices in the field being highlighted for policy makers with evidences and making them known for a larger set of stakeholders. This is an area where RPL experience may cross RPL's and their contract farmers' boundaries. This includes documenting evidence that water efficient practices are economically viable for multiplication and crowding in. The warabandi system will be documented as practiced for a reference. An assessment of groundwater study has been planned to ascertain depletion trend as a baseline and check the impact of water efficiency on this resource. Coupled with the improved governance pillar, this area of WUMP looks into the issue of water theft and mitigation measures through already existing mechanism of "water theft control committees" at district level, and piloting of smart monitoring. A seminar / conference on the

[2] Before formation of farmers associations, it is needed to restore the farmers confidence on association

[3] In rice growing areas, laser leveling has to be carried after every alternate year. Thus it is continues practice and the leveling cost should be in correlation with increase in yield.

subject of maintenance of century old canal irrigation system of Punjab is also planned with all important stakeholders, possibly with support from other interested donors active in water sector. Up-scaling of WAPRO example in rice is also aimed by exploring more interested private sector actors and donors.

4. **Water quality and awareness raising:** It mainly addresses the quality of water aspects for both drinking and irrigation purposes which will be addressed through awareness raising among water users, concerned stakeholders and decision makers. In this area, the idea is also to translate existing awareness and technical education materials into Urdu language for wider dissemination, promote water saving practices through messages and introduce remedies for issues arriving from various studies such as situation of women transplanters, groundwater depletion and quality of drinking water.

The implementation of the plan will be partly carried out through the resource available with WAPRO partners as well as siphoned from other stakeholders including the Government of Punjab with their regular programmes for which the RPL and HELVETAS will have a close networking with the concerned departments. Private sector partner RPL, which is responsible for push and pull components of the project, is already implementing the elements of improved governance and sustainable water balance through contractual farming. Whereas policy related elements will be taken up for lobbying and dialogues by HELVETAS Swiss Intercooperation in a collaborative manner.

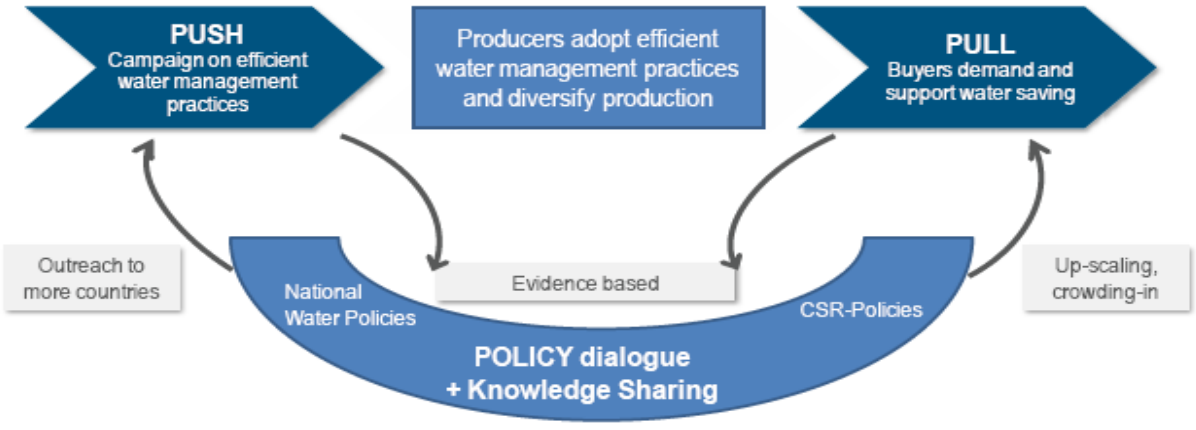
The plan has been envisaged for 2017-2019 and forms a basis of collaboration and advocacy among and with all relevant partners. This is a pilot initiative and therefore further improvement with time in the actions is quite possible and encouraged.

1. Introduction

1.1 About WAPRO

Experiences from around the world indicate that water and irrigation issues are a key concern for global food security and that potential water conflicts are an essential risk for water scarce regions. Positioned within the Global Programme Food Security of the Swiss Agency for Development and Cooperation (SDC) a multi-sectoral group of actors under the lead of HELVETAS Swiss Intercooperation allied to roll out an innovative approach to address inefficient irrigation practices in smallholder farming of cotton and rice in India, Pakistan, Tajikistan and Kyrgyzstan.

The alliance defined as WAPRO is based on the insight that the complexity of water productivity in the field cannot be tackled by individual actors. The WAPRO was conceived in September 2014 and has been planned with a water stewardship component that allows acting on the level of farmers' groups as well as on the local policy level relevant for irrigation areas of Punjab where rice and cotton are cultivated. Global initiatives in water sector stress the need for integrated approaches based on multi-stakeholder dialogues (Dublin 1992, UN Water 2014). Such initiative however are missing in the rice cultivation areas in Pakistan. In Pakistan, the WAPRO project addresses enhancement of water use efficiency and food production in rice value chain in the areas of Muridke, District Sheikhupura. The project is based on "3 Ps"; Push, Pull & Policy, which refer to adoption of best water management practices from a combination of effective promotion and outreach in rice value chain (push). The other pillar of the project is the articulation of buyer demand and their support for water-saving and crop diversification (Pull). As a result, smallholders produce more food and gain more income, contributing to reduced water footprints and increased food security. Promoting this approach, sharing best practice and demonstrating impact will influence the Policy, which is the third pillar of the project.



There are four key partners in Pakistan that are important to mention:

Rice Partners Limited (RPL) is a lead private sector partner in WAPRO initiative working first-hand with the farmers through their team based in Muridke, District Sheikhupura and taking practical steps towards ensuring water stewardship. RPL is a national supply partner of **MARS** (owning the renowned rice brand Uncle Ben's Rice). Mars and RPL jointly aim to steer water efficient production of basmati rice in Punjab area. Scaling-up of this approach to other Rice companies in Pakistan will be facilitated by the **Sustainable Rice Platform** (SRP). Policy and governance related aspects, while making reference to the best practices and living examples in the field, are being facilitated by **HELVETAS Swiss Intercooperation** in close collaboration with all relevant partners including the government.

1.2 The need for a plan – objectives

This water use management plan is a pilot for Joyianwala Minor with the specific objectivestoprovide a *Systematic ground for water stewardship in rice value chains to acquire water efficient and sustainable rice production model with multi-stakeholders and build a case for future up-scaling.*

This plans aims to achieve the following:

- **Assess and determine water resource availability**, existing uses and requirements.
- **Improve water use efficiency** of rice by promoting effective water uses as well as better agronomic approaches.
- **Determine structural and non-structural water access and equity issues**; and balance these through interactive dialogues
- **Promote coordinated action** among different stakeholders (communities, government, non-government organisations and private sector).
- **Strengthen local institutional capacity** in favour of collective thinking on water use efficiencyand economically and socially disadvantaged groups.
- **Act in support to policy / decision makers:** Interactive dialogue based on concrete field examples for improved irrigation frame condition in Punjab on a larger scale.

1.3 The process to carve water plan

The current water use master plan was prepared by adopting the following four main stages:

1. **Preparatory Stage:** All the necessary and concerned stakeholders from government, private sectors, civil society organizations, farmers of rice value chain and key informants wereidentified. The objective and methodology of water use plan was discussed in detail and consensus wasbuilt regarding the main foci and content for the preparation of the Plan.
2. **Assessment and Analysis stage:** This stage entailed primary data collection to arrive at area and socioeconomic profile of farming community, farming system, overall assessment of water availability in rice cultivation, and gender assessment in rice value chain were conducted. The information so gathered was analysed for mapping the main issues, problems and challenges in the use of irrigation water in Muridke areas with particular focus on Joyianwala minor.
3. **Planning Stage:** In this stage all the gathered information from stage 2 was shared with the concerned stakeholders in a two days' workshop. A details discussion led to identifying 4 core areas for the plan and activities for a concise and comprehensive water use plan.
4. **Final consultation:** A draft plan was placed for a final consultation in Islamabad with key stakeholders (RPL, Irrigation Monitoring Unit, Irrigation department Punjab). In addition this document was also shared with Mars for their feedback.

2. Benchmarks

2.1 Where does WAPRO stand today in the field (2016)

WAPRO began to operate in mid-2015 but practically was initiated in the field in February 2016.During this period the following activities were performed:

- Dialogues with various stakeholders continued on the basis of baseline study conductedinwinter / spring 2015 on major water issues requiring attention and what to include in water use management plan
- A gender study has been conducted to evaluate women's role in rice value chain andtheirpossible future role in case of technological evolution (2016)

- Trainings of Trainers (TOTs) were conducted with 110 selected farmers on Land laser levelling, AWD and DSR. These master trainers are replicating knowledge gained in trainings to peer farmers
- 4000 acres of land was identified and levelled in May 2016 and different techniques were used during rice season
- Data analysis and documentation of various techniques was conducted
- Field assessment and consultative workshops were held to prepare water use management plan for Joyianwala

The baseline assessment conducted by WAPRO (**Annex 1**) in March, 2015 indicated that:

- 22% framers don't perform crop rotation and follow typical farming cycle i.e. cultivation wheat followed by rice. Rice crop has the major share in terms of acreage cultivation in crop rotation system. 70% of rice areas are irrigated and the number of irrigation days is significantly higher for rice (51-60 days), compared to 0-3 days for other crops.
- The major problems perceived regarding irrigation are bad condition and maintenance of irrigation channels, lack of specialist for irrigation infrastructure, no proper levelling of ricefields, high costs of water due to high energy consumption, timing of water availability for irrigation does not fit farmers' requirements and lack of local leadership to facilitate fair water distribution.
- Regarding food, farmers claim to have enough food from own production for their family needs for 12 months with average net income of USD 12,380 from rice production.
- Farmers are supposed to clean their water channels on voluntarily basis. Cleaning of water channels don during January - April. While cleaning of main water channel (distributary) is carried out by the government once in two or three years which is mainly depend upon the availability of funds.
- All farmers pay a fee for receiving irrigation water. Few years back, electricity for tube wells was subsidized by the government, therefore irrigation through tube wells was preferred by the farmers rather to be depend on canal water. The government has now increased electricity charges in the country. Farmers claim that they can't afford the bills and are asking for more water in the canals.
- Only 2% farmers indicated that they know water related regulations. National laws and policies for irrigation are implemented by the irrigation department. However, during the assessment, stakeholders were not able to mention any measure taken or policy made to addresses water productivity.

Followed by this baseline, **a gender assessment** was conducted of the rice value chain which concluded that Women are mainly involved in the transplantation work and that they are most neglected segment in the rice value chain. They spend approximately 45 days' in transplantation on millions of acres in the country. During this period farmers and transplanting women work under enormous pressure to accomplish the task in time for optimum rice yield. The transplantation work poses significant health hazard for these women. Women's' contribution as transplantation workers does not constitute a higher percentage of household income. With changing agronomic techniques (e.g DSR), they may lose this income. With new agronomic techniques the nature of labour requirement may change. There is a need to work out how women could be involved in rice value chain in the future. For example, in case farmers opt to switch to dry seeding technique, the possibility of engaging women in manual weeding instead of using herbicides may be explored (executive summary of gender study in **Annex 2**).

2.2 The key Stakeholders

The following four types of stakeholders are found in Muridke Sheikhupura areas with respect to interest in water use productivity of rice value chain. The same is relevant for Joyianwala Main:

	Interest High	**Interest Low**
Influence High	**Major / direct Players** • RPL and RPL farmers • Mars Food • Canal Operators, XEN, SDO • On Farm Water Mgt. department • REAP (Rice Export Association) • Rice Research Institute Kala Shah Kaku • Commission Agents	**Controllers** • Punjab Bank • District Nazim • MPAs • MNA • Assistant Commission Tehsil • Irrigation Department • Irrigation Monitoring • WAPDA
Influence Low	**Neglected Players** • Non RPL farmers • Women labour in rice value chain • International Rice Research Institute (IRRI) • Pakistan Agriculture Research Council (PARC) • Extension Department • Other private sector companies (Similar to RPL or local)	**Marginal players** • Engro Fertilizers (Rehbar) • Banks (APNA bank, NBP, MCB, ZTBL • UBL, HBL, Akhuwat) • Universities: Arid Agriculture University RWP; University of Agri FSD; Universities College of Agri Sargodha • WB with Govt. • Agri. Policy Institute (API) • Dep. Of plant protection • Insurance Companies • Trading Corporation of Pakistan

1. **Stakeholders with high influence and high interest:** These are the *major players* which are at the moment directly involved in water efficient production in Muridke. These include operational cadres of Irrigation department such as Canal Operators and SDO, Revenue department (Patwaris), On Farm Water Management (OFWM), Rice Farmers (RPL), Commission Agents, Rice Partners' Limited and Rice Exporters Association.

2. **Stakeholders with high influence and low interest:** These are the *Controllers* which includes members of national and provincial assemblies (MNAs & MNAs), representatives of local government (Nazim, Councillors), irrigation department (policy level, PMIU), major banks in Punjab.

3. **Stakeholders with high interest and low influence:** These are the *Neglected Players* which include, Rice Research Institute, Engro Fertilizer Company, the Agriculture Extension, Pakistan agriculture Research institute (PARC), Ayub Agriculture Research Institute (AARI), Universityof Agriculture Faisalabad, Non RPL Farmers, Federal Seed Certification and Registration Department (FSC&RD).

4. **Stakeholder with low interest and low influence**: These are the *Marginal Players* which include commercial banks (ZTBL, UBL, HBL, NBP, MCB, Apna Bank), Akhuwat, WAPDA, World bank, National Rural Support programme (NRSP), Insurance Companies, Trade CorporationofPakistan (TCP), Agriculture Policy Institute (API).

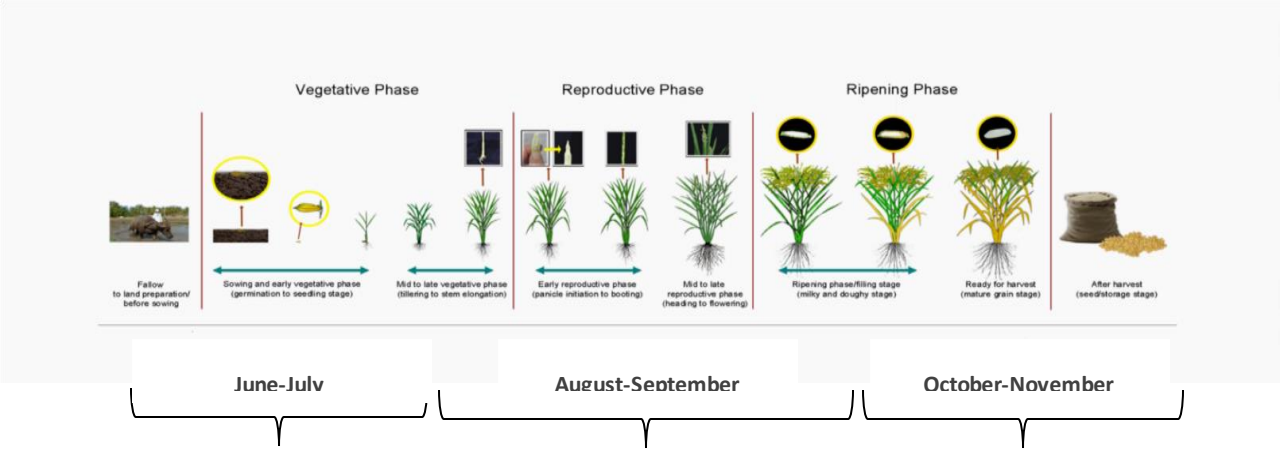
2.3 Rice productivity and income

Pakistan ranks 3rd among the top ten rice exporting countries of the world. Rice is the 3rd largest crop in terms of area sown and 2nd most important economic crop after cotton[4] engaging over 700,000 farm labour including 15,000 women transplanters[5] on 4.4 million acres in Punjab (60% of country's rice cultivated area).

Production zone	% of Total harvested area)
Punjab	59.46
Sindh	32.13
Khyber Pakhtunkhwa	2.86
Baluchistan	5.52

The current rice production practices are high water demanding contributing to 6%[6] of national GHG emissions in the form of Methane with high global warming potential. No other single crop has such a huge share. Punjab is world famous for Basmati rice located between the Ravi and Chenab rivers. Major Rice producing areas of Pakistan include Gujranwala, Hafiz Abad, Sheikhupura, Sialkot, Jhang& Okara of Punjab and Larkana, Jacobabad, Shikarpur, Badin, Dadu and Thatta districts of Sindh.

Rice Seasonal Calendar: Rice is planted between July and November. The following table shows the timings of various operations of rice value chain throughout the year.



There are two types of farming system in Muridke –Sheikhupura. 1) Wheat-Rice-Fodder and 2) Rice-Berseem. As per estimates of Agriculture Extension department in Muridke, the total arable land is 180,000 acres whereas, Culturable waste land is 20,000 acres. Wheat is usually cultivated on average land of 130,000 acres, rice on 160,000 acres, Berseem on 28,500 acres and vegetable on 1500 acres.

[4] Pakistan Agriculture Statistics – 2016. Government of Pakistan
[5] https://www.pyxeraglobal.org/water-use-efficiency-action/
[6] National Economic and Environmental Development (NEED) study 2011 – UNFCCC, Government and Pakistan

Particulars	June				July				August				September				October				November			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Land Preparation																								
Plant Nursery																								
Transplant Field																								
Direct seed Field																								
Fertilizer																								
Irrigate																								
Weed																								
Insects																								
Disease																								
Harvest																								

One of the major reason of such gap is the shortage of irrigation water, particularly at the time of cultivation of the crops. This is due to the fact that at the time of designing the irrigation system, the cropping intensity of the province was 67% whereas it now increases up to 120% to 150%. This is more than double of the requirements for which the current irrigation system is not sufficient and has to switch itself to supply driven instead of demand driven. The other challenges related to low yieldare:

- Access to quality seed and inputs
- Pest management and infestation
- Lack of new varieties in paddy
- Harvesting and post-harvest losses
- Payment issues in marketing
- Farmers indebtedness
- Low market prices

Besides these, the following risks are associated while cultivating the rice-wheat and fodder system:

- Health hazards due to poor safety measures during various production steps
- Poor drinking water, sanitation and limited access to health facilities
- Area is prone to floods as well as heat waves
- Rainfall pattern is changing and evaporation losses increased due to climate change,

2.4 Rotation System in Irrigation (Warabandi)

Rotation system, also called Warabandi system is the method of provision of irrigation water to the farmer's community. It is important in the cases where water is scarce and cannot provide to the farmers as per their land availability. However, the rotation system in Punjab is fixed as compared to some other parts of the country where the system is flexible and is usually adjusted as per crop situation. According to On Farm Water Management (OFWM) sources, the total supply of irrigation water is 45 Million Acre Feet (MAF) as compared to its requirement of 65 MAF. The gap of 20 MAF is being fulfilled through ground water and rains. In case of canal water, farmers get turn after every 7 days as per their land. Irrigation time is about 22-44 minutes/ acre and there is a provision of 20-25 times irrigation in the whole season.

2.5 Water use efficiency today

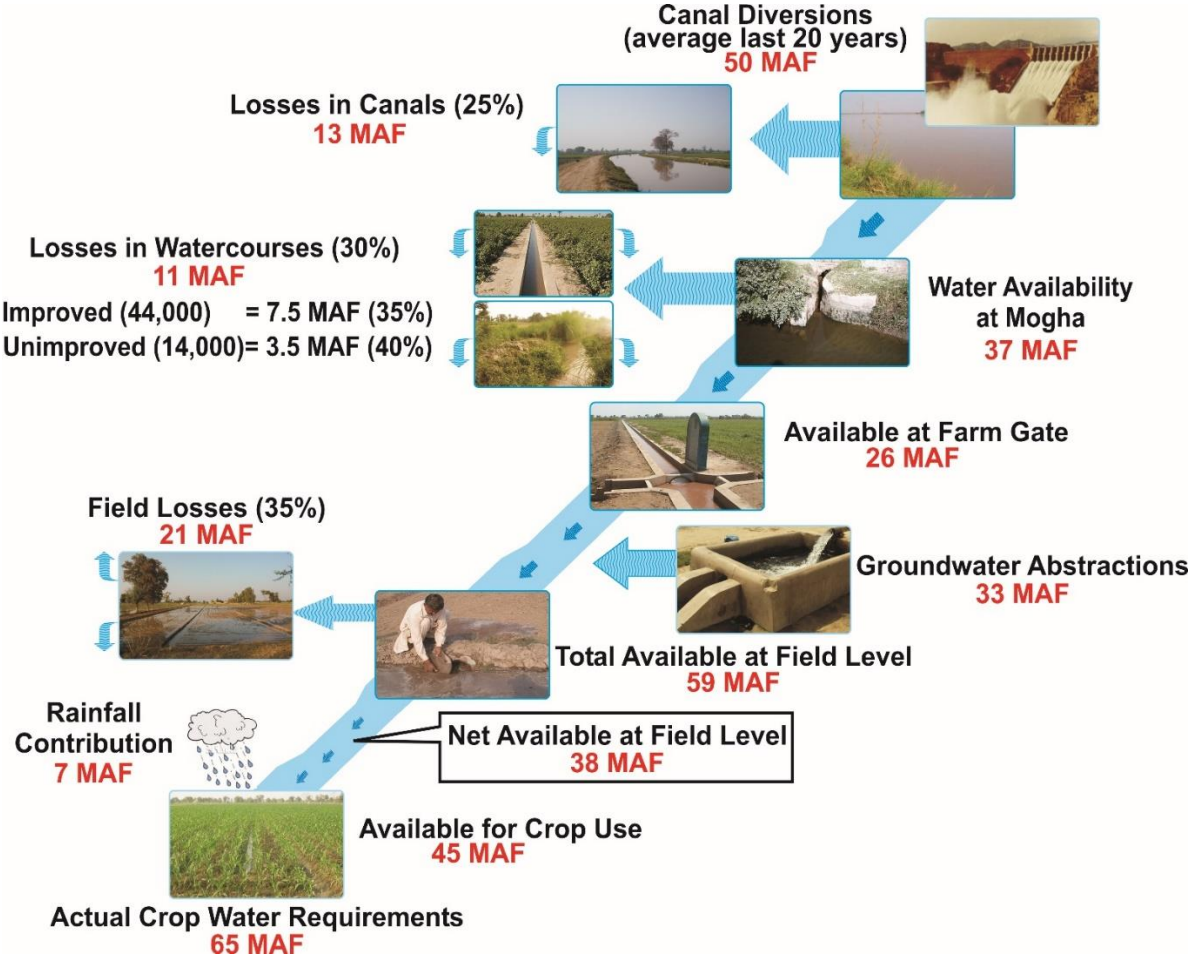
Currently, the irrigation efficiency as a whole in Pakistan is a challenge with only 35.5%. About 40% of water is reportedly lost from source to the farm gates[7]. Despite excess water for irrigation, Pakistanis among the countries with the lowest yield/unit area (2.95 tons/ha)[8]. In rice sector, Pakistan's crop productivity per unit of water is 55% below for rice among other Asian countries growing rice. According to On Farm Water Management Department Punjab (OFWM), water efficiency today from source to the field is highly sub-optimal today. Some of the reasons are following:

1. Aging irrigation infrastructure built by the British or the Government of Pakistan decades ago
2. Inflexibility in the system due to uncontrollable round the clock water operation or a complete shutoff
3. Excessive seepage losses in canals and watercourses
4. Low application efficiency due to unleveled fields
5. Deficit irrigation supplies: Requirement is 65 MAF in the catchment whereas availability drops to 45 MAF. Seasonal availability of water also varies.
6. Over exploitation and pumping of groundwater. As oppose to an approximate recharge of 23 MAF, pumping exceeds 33 MAF. Hence surface irrigation is supplemented by groundwater mining rather than improving the efficiency of the system
7. Huge drudgery in irrigation operation which at times is not well coordinated
8. Obsolete application methods of fertilizers and other chemicals without any mechanization reduces quality of water and chemical leaching into freshwater
9. Unscheduled or over application of irrigation water because of lack of proper soil moisture measurement tools
10. Courses under farmers' responsibility not regularly maintained
11. Quality of groundwater monitoring is inadequate and sub optimal – and there is a high depletion of water table.
12. No proper cases of economics documented or available in favour of innovative for reduced water application.

The following info-gram presents water efficiency dilemma:

[7] World Dam Commission report 2008

[8] The green, blue and grey water footprint of rice. UNESCO-IHE 2010



2.6 Access to water for drinking / domestic use

Mainly groundwater is used for drinking. It is extracted by the installation of hand pumps and tubwells on self-help basis. Overall the quality of drinking water is not good which was also confirmed by a gender assessment study (2016). There were serious concerns regarding health facilities. Hepatitis and Cholera are among the common problems. The reason behind this issue is use of contaminated water. In most of the areas the water is not safe for drinking. About 70% of the women respondents said that they were also facing diarrhea, scabies, allergies, TB and goiter issues. Kidney problems were also reported by 4% of the women. However, no systemic and planned (hydrological, hydro geological, geophysical etc.) investigations have been carried out for the quality, quantity, availability, demand and balance of water resource in the Muridke-Sheikhupura areas.

2.7 Access to information

There is no system of information provision to the farmers' community on Agriculture. The farmers are mostly depended on commission agents and inputs dealers who are their contact persons for information. However, RPL contracted farmers are more aware and guided properly through the provision of rice related information by sending regular mobile messages. This information is related to agro-economic practices and reminder for timely using inputs. The system need to be upgrade by including weather information, adjustment of farming system as per climatic variations along with market reacted information. This useful information system needs to be extend to non RPL farmers with the help of other stakeholders such as Agriculture Extension Department who has a vast network of farmers and field assistants. Media, particularly FM radio can play very important role in disseminating agriculture related information to the larger segment of farming community in more effective and efficient way.

2.8 Institutions

Farmers associations does not exist in the area. This serves a challenge to government institutors, such as Agriculture Research and Extension, who are often restricted to their offices with supply driven advice since farmers do not approach them with representative issues. The *warabindi* systemsystems could provide an entry point to organize formers into association. Water theft is a chronic issue at the upstream level, particularly at the start of Kharif season when water availability is short for irrigation. When the situation becomes worst, the farmers immediately switch to groundwater extraction through tube wells as the installation of tub wells is easy and water can easily be extracted up to 20 feet. Cleaning of minors is the responsibility of the government departments and it is supposedtobe carried out once in a year but usually it is carried out once in three years due to limited resources. Use of technology for water use efficiency is negligible and mostly farmers rely on traditional wayof flood irrigation. Linkages of farmers with technology related government departments and projects are deficient. Farmers observe changes in climate however they are not aware of trends and howtoadapt their practices to climate change. The area is prone to floods but there is no preparedness in case a disaster hits.

2.9 Issues for Policy Deliberation

The whole irrigation system of Punjab was designed for the crop intensity of 67% but with the passage of time, the crop intensity has increased up to 150% but the irrigation system remained the same and no improvement was made for the storage of additional water. The total storage capacity of water reservoirs is for 30 days which has further reduced due to sedimentation. The shortage of water is fulfilled by extracting underground water through unregulated pumping which has led to depletionof underground water resources. There is no proper monitoring or regulation existing for groundwater depletion. This issue has further aggravated by the loss of water in the main earthen canals. Theyneed continuous maintenance for the smooth flow of irrigation water. These issues made the equitable distribution of water very difficult and further aggravated at the downstream due to water theft. The Irrigation department has taken some measures to ensure smooth implementation of the rotation system of irrigation. Some of the important measures are;

- Formation of district committees to monitor water theft under Assistant Commissioner
- Strict implementation of canal rotation plans
- Employment of canal guards
- External monitoring, shift to smart monitoring
- Farmers feedback system
- Daily review of supply at head and tails
- Canal division wise targets and fortnightly review
- Water theft control teams under Assistant Commissioner
- Registration of cases, Abiana / tawan recovery
- Amendments in laws to improve efficiency

The monitoring section of the Irrigation department (PMIU) has developed Complaint Management System for efficient redressal of complaints with respect to canal operations, water theft, shortageof water & rotational program issues.

2.10 Key Issues in Joyianwala minor area

An assessment of Joyianwala minor (minor canal) was also conducted in which a number of issues were explored for inclusion in water use plan (report **Annex 3**). This assessment identified the following key issues:

- Electricity issues included low voltage, long duration power cuts and high cost of electricitywhich affect the irrigation supply.

- Water quantity of irrigation water is not sufficient from canal due to which farmers' supplements from tube wells.
- The area has only water for irrigation in summer (Kharif) season in which rice crop is grown for the duration of 4- 6 months.
- Complaints of water theft reported at up-stream & mid of the minor observed at the time of rice sowing.
- The major concern of the farmers was about cost of electricity and fuel. Monthly electricity cost was estimated at Rs.20,000 while cost of diesel in dry season was Rs.40,000.
- The small farmers having land less than 10 acres don't invest much in tube wells installation rather they buy water from the tube wells owners. In case of rice they pay Rs.6,000 – 7,000/acre for the whole season
- The groundwater table is depleting, yet still close enough so that the farmers can easily install tube well with little investment. This might be the reason of less attention of department to the irrigation system improvement in the area.
- Minor and water courses are un-lined and an average up to 25-30%[9] water is lost till the farm gate. Beyond this point, there are no studies but an ocular observations suggests and as large as 50% of water is lost from water courses and does not reach crops.
- Super Hit Basmati delays wheat sowing by 15-20 days as this is long duration variety which results in less yield of wheat.
- The winter season has shortened by almost one month while summer season has expanded. Due to this shift in summer being a long season, the sowing of rice is 10-15 days earlier compare to 15 year back.
- There seems no proper mechanism for O&M, the farmers reported cleaning water course every year. However, the cleaning of the minor and water courses is Govt. responsibility
- The water tariff is very low and farmers pay Rs.180-200 per season/ acre.
- In case of good rains, they don't apply water to their crops but there is no surplus water to grow more land or sell it to other farmers especially from canal.
- In terms of socio-economics, the villagers' ranked 1st priority to the drinking water supply schemes (DWS) and sanitation and health were ranked 2nd. Education situation was also not good and strongly felt as needed in the area. Area around Joyianwala minor is prone to flood.

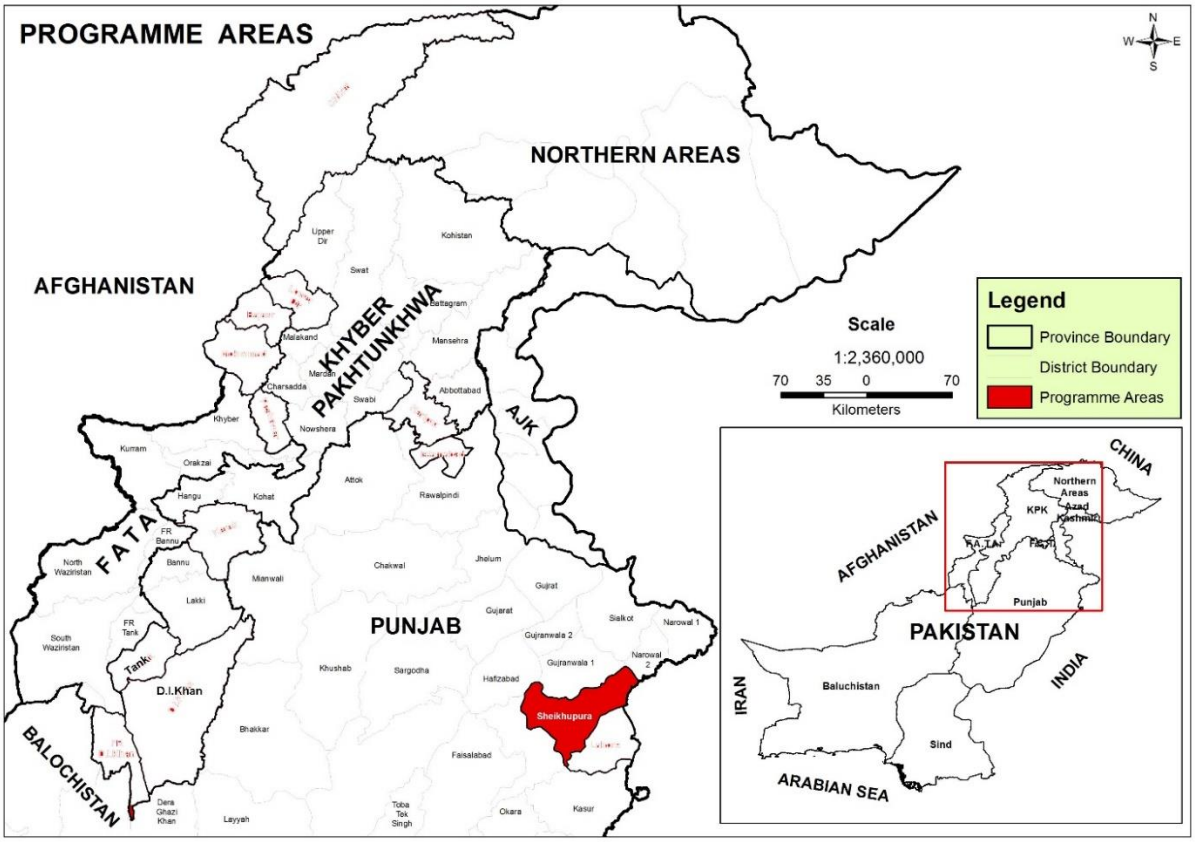
[9] *A figure quoted by Punjab Irrigation Department*

3. Area profile

3.1 Location of Joyianwala in Muridke

Muridke is located in the center of traditional Basmati rice belt and a Tehsil headquarter of District Sheikhupura in central Punjab. It is located on the famous Grand Trunk (GT) Road and Lahore-Rawalpindi Railway track, 27 Km on the north of Lahore at an elevation of 205 m (675 ft.) and well connected with other town of the areas including Kala Shah Kaku, Sheikhupura, Kamoke, Narang Mandi and Narowal. Rice, wheat and fodder crops are predominantly cultivated under irrigated system. It is estimated that over 25 rice mills are located in a radius of 4-5 Km in Muridke. A well-known Rice Research Institute of the government is also located mandated with breeding basmati rice varieties. The total populationof Muridke was estimated to be 164292, mainly dependent on agriculture and agro-based industries.

Joyianwala is located in north east of district Sheikhupura; it is about 15km away from main Muridke Sheikhupura road. The population of the Joyianwala is about 6000 to 7000 households with average of 5 person per household. Reported women population of the village is 45% and men are 55%, theliteracy rate is about 60%. There is one middle school for boys and one middle school is for girls. But there is very limited staff to teach the students, particularly in girl's school. There is hardly any single health facility in village; people have to travel to district Sheikhupura to get the medical treatment. The major source of income for villagers is linked with agriculture. 90% population is associated with this sector, rest of the people work in small industry. Joyianwala village comes under UC no 19 Qila Satar Shah.



3.2 Climate conditions and trends

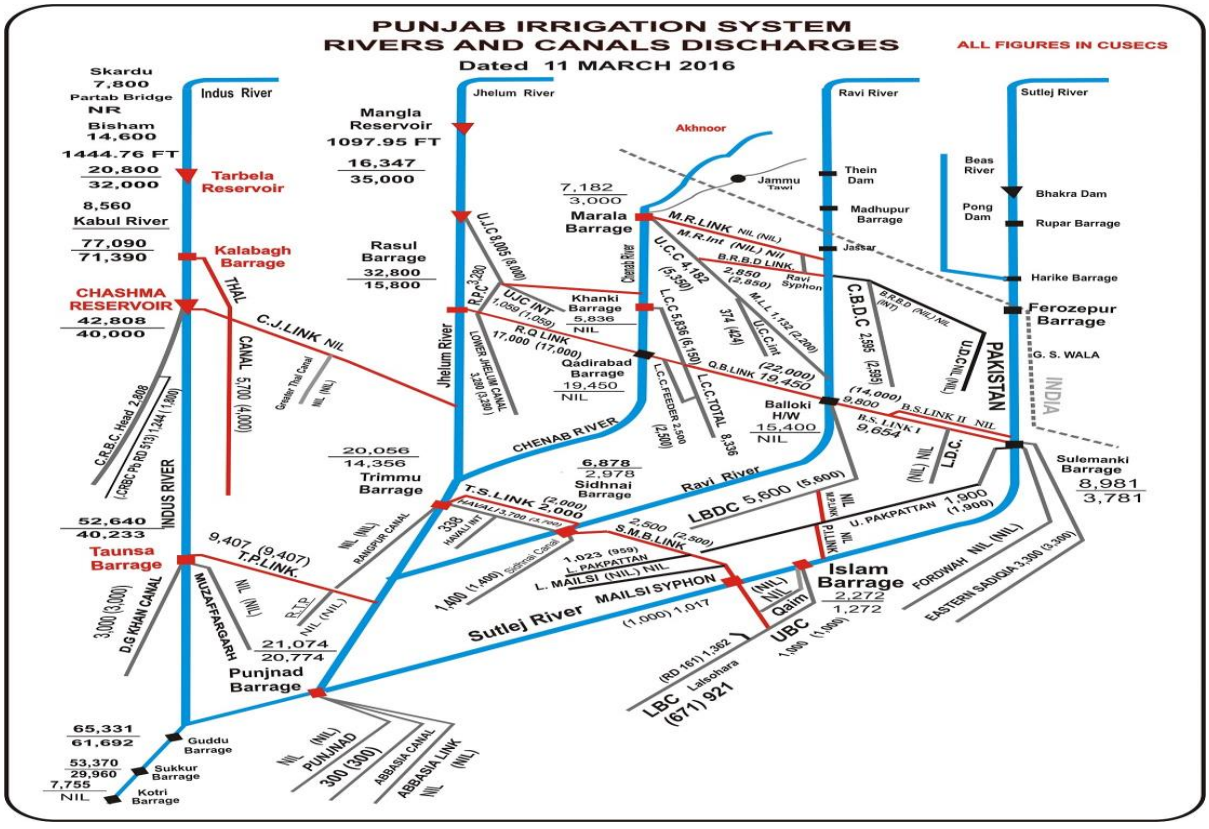
Pakistan is located in heat surplus zone. Punjab receives regular monsoon rains. However temperatures and rainfall patterns are changing. Over the last three decades, the following changes have already been noticed in the climate pattern:

- Monsoons are delaying and encroaching relatively drier periods
- Rains are more intense and occur during short durations rather than being stretched over a long span. This results in crops damages and sometimes floods. Punjab experiences recurrent floods for the last few years.
- Winters are shrinking and summers are prolonged. We have very short springs and autumns
- Winters are dryer than before. Winter rain spells occur late, even later than January
- Day temperatures are increasing during winters and nights are becoming cooler. This suggeststhat diurnal differences are increasing which may be harmful for the crops.
- In case of summers, both night and day temperatures are increasing.
- Generally, there is an average rise of 0.8 degree in temperature per decade. This may be minor but for crops and water regimes related to crops this is crucial shift.
- Evapo-transpiration has increased due to rise in temperature and extended dry spells.

The studies conducted by Pakistan Meteorological department and Helvetas in upstream areas show that summers have a greater flow of water due to high melting of glaciers. This may be a good news for canal irrigated areas. However after two decades, this flow may reduce and the re will belesswater in the system. All possible measures must be taken to ensure that within less than two decades we acquire substantial water efficiency in our farming system otherwise we cannot sustain food production at the current level in Pakistan.

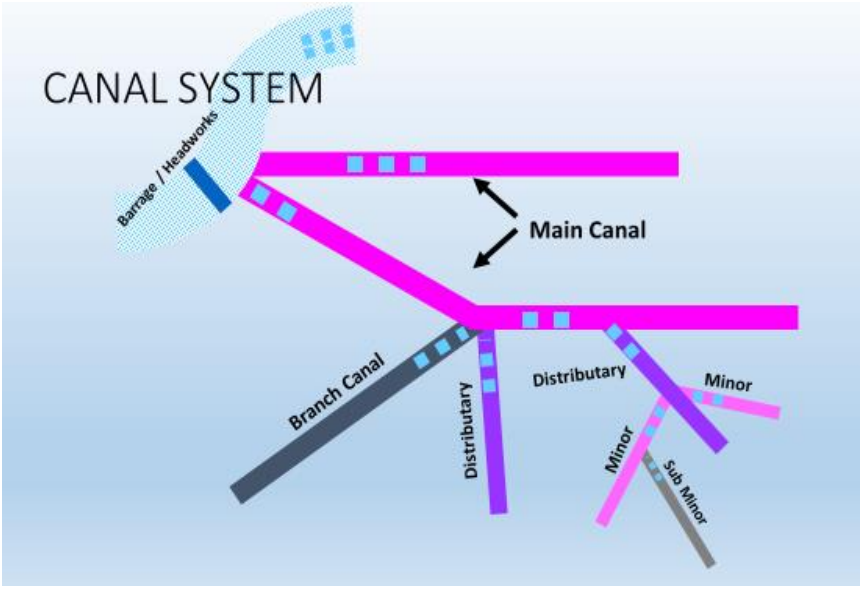
3.3 Water resources

The irrigation System of Punjab consists of about 23,184 miles length of canals, with cultivable command area (CCA) of about 21 million acres. The irrigation water is delivered to the field through a network of barrages, main canals, branch canals, distributaries, minor canals, sub minors canals and outlets. The 24 canal systems, which have a total capacity of 0.11million cusecs, draw their allocated discharges from 14 barrages. The barrages also control diversion of supplies to the inter-river link canals which transfer the water of the western rivers to the eastern rivers to cater for irrigation systems off taking from these rivers. The water from the rivers is diverted to Main Canals / Link Canals from Barrages and head Regulators and distributed to the farmer's fields through



58,000 outlets after flowing through the lengthy irrigation net-work. Muridke Tehsil is mainly irrigated by Upper Chenab Link Canal (UCC). The following diagram shows complete picture of irrigation system of Punjab encircling Joyianwala Minor for convenience purposes;

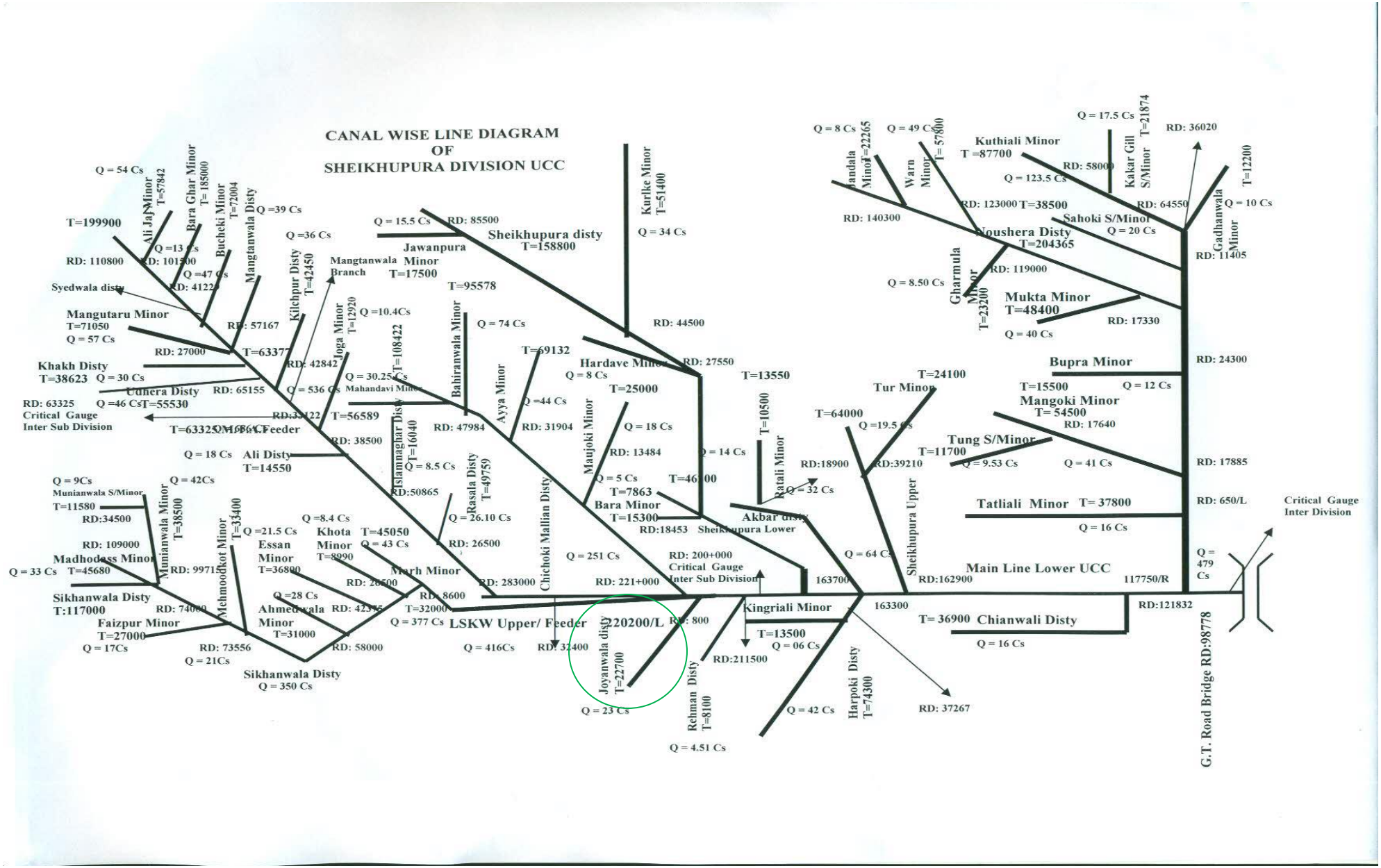
The Joyianwala minor falls under Sheikhupura zone and comes from Sikhawala Distributary whichhas a direct link with Upper Chenab canal. It covers almost a radius of 50 square kilometer. The following is the complete picture of the canal system and Joyianwala minor.



The Sheikhupura Zone has the following 6 distributaries:

1. Noushera Distributary
2. Sheikhupura Upper Distributary
3. Akber Distributary
4. Sikhanwala Distributary
5. Chichokimalian Distributary
6. Lower Sheikhupura Distributary

The complete picture of Sheikhupura zone, encircling Joyianwala Distributary, is given below:


CANAL WISE LINE DIAGRAM
OF
SHEIKHUPURA DIVISION UCC
Q = 54 Cs
T=199900
Ali Jaf Minor T=57842
Bara Ghar Minor T= 185000
Bucheki Minor T=72004
Mangtanwala Disty
Q =39 Cs
Q =36 Cs
RD: 110800
RD: 101500
Q =13 Cs
Q =47 Cs
RD: 41220
Syedwala disty
Mangutaru Minor
T=71050
Q = 57 Cs
RD: 27000
RD: 57167
T=63377
Kilchpur Disty T=42450
Mangtanwala Branch
Jawanpura Minor T=17500
Q = 15.5 Cs
RD: 85500
Sheikhupura disty T=158800
T=95578
Kurike Minor T=51400
Q = 34 Cs
RD: 44500
Khakh Disty
T=38623
Q = 30 Cs
Udhera Disty
RD: 65155
Q = 536 Cs
Joga Minor T=12920
Q =10.4Cs
RD: 42842
Q = 30.25 Cs
Mahandavi Minor
T=108422
Bahiranwala Minor
Q = 74 Cs
T=69132
Hardave Minor
Q = 8 Cs
RD: 27550
T=13550
RD: 63325
Q =46 Cs
T=55530
Critical Gauge
Inter Sub Division
T=56589
Islamnagar Disty T=16040
RD: 47984
Ayya Minor
RD: 31904
Q =44 Cs
T=25000
Maujoki Minor
Q = 18 Cs
RD: 13484
Q = 14 Cs
T=10500
Ratali Minor
Q = 32 Cs
T=46100
T=7863
Bara Minor
T=15300
RD:18453
Sheikhupura Lower
Akbar disty
Q = 5 Cs
RD: 38500
RD:50865
Q = 8.5 Cs
Rasala Disty T=49759
Q = 26.10 Cs
RD: 26500
Chichoki Mallian Disty
Q = 251 Cs
RD: 283000
RD: 221+000
RD: 200+000
Critical Gauge
Inter Sub Division
163700
Q = 64 Cs
Sheikhupura Upper
Main Line Lower UCC
RD:162900
117750/R
Q = 479 Cs
Critical Gauge
Inter Division
Q = 18 Cs
Ali Disty
T=14550
Q = 9Cs
Munianwala S/Minor
T=11580
RD:34500
Q = 42Cs
Munianwala Minor T=38500
Mehmoodkot Minor T=33400
Q =8.4 Cs
Q =21.5 Cs
Khota Minor T=45050
Q = 43 Cs
T=8990
Essan Minor T=36800
Marh Minor
RD: 26700
RD: 8600
T=32000
Q = 377 Cs
LSKW Upper/ Feeder
RD: 32400
Q = 416Cs
RD: 109000
Madhodass Minor
Q = 33 Cs
T=45680
RD: 99715
Sikhanwala Disty
T:117000
RD: 74000
Faizpur Minor
T=27000
Q = 17Cs
RD: 73556
Q = 21Cs
Q =28 Cs
Ahmedwala Minor T=31000
RD: 42345
RD: 58000
Sikhanwala Disty
Q = 350 Cs
Joyanwala disty T=22700
Q = 23 Cs
Rehman Disty T=8100
Q = 4.51 Cs
RD: 800
RD:211500
Kingriali Minor
T=13500
Q = 06 Cs
163300
Harpoki Disty T=74300
Q = 42 Cs
RD: 37267
T= 36900 Chianwali Disty
Q = 16 Cs
RD:121832
G.T. Road Bridge RD:98778
Q = 8 Cs
Jandala Minor T=22265
Q = 49 Cs
Warn Minor T= 57800
Kuthiali Minor
T =87700
RD: 140300
RD: 123000
Q = 123.5 Cs
RD: 58000
T=38500
Kakar Gill S/Minor T=21874
Q = 17.5 Cs
RD: 36020
RD: 64550
Sahoki S/Minor
Q = 20 Cs
Noushera Disty
T=204365
Gadhanwala Minor T=12200
Q = 10 Cs
RD: 11405
Gharmula Minor T=23200
RD: 119000
Q = 8.50 Cs
Mukta Minor
T=48400
RD: 17330
Q = 40 Cs
Bupra Minor
RD: 24300
T=15500
Q = 12 Cs
Mangoki Minor
T= 54500
RD: 17640
T=24100
Tur Minor
T=64000
Q =19.5 Cs
RD:18900
RD:39210
Tung S/Minor
T=11700
Q = 9.53 Cs
Q = 41 Cs
RD: 17885
Tatliali Minor T= 37800
RD: 650/L
Q = 16 Cs

There are 13 Mogas (outlets) on Joyianwala canal (minor) which irrigates 5266 acres of land for the population of 17150 following table shows the complete picture of supply of irrigation water at each Moga.

Table 1: Villages and irrigation outlets on Joyianwala Minor

S.NO	Name OF Villages	TYPE & Size Of MOGAS.B/DIA	Population	Cultivated Catchment Area(CCA)	NO.MOGAS & their NOs
1	Joyian Wala	Pipe,7 Inches	2000	811	Two NO.2500,2600
2	Bawar Kalan	APM,0.4	50	478	One,NO.7550
3	Chak Sekhum	APM,0.25	10000	414	One,7550
4	Pindi Ratan Singh	Pipe,7 Inches	1000	403	One,NO.8700
5	Sekhum	APM,0.4	1600	736	Two NO.12300,12700
6	Chak Sannata	Pipe,7,5 Inches	800	491	One,NO.129500
7	Khushal Pura	APM,0.3	500	544	One,NO.16300
8	Pind Leel	SWF,0.93	400	739	Two NO.18800.
9	Kathiawala	SWF,0.56	800	650	Two NO.22700.
	TOTAL	SWF,0.82	17150	5266	13 MOGAS

Water Allocation of the Project Areas

The following table below shows that for the current Kharif season, the entitlement or allocation of water for the whole Sikhanwala feeder system is 56.51 Acre Feet (AF) of the total allocation share of 1000 AF. Out of the total 56.51 AF, Joyianwala Distributary is entitled for 3.249 (AF) for entire Kharif 2016 season.

Table 2: Actual and Tentative Distribution Programme Kharif, 2016

S#	Channel Name	Total Share (1000 AF)
1.	Joyianwala Distributary	3.249
2.	Sikhanwala Upper	53.261
	TOTAL:	56.51

Field Observation/ Actual situation regarding water for irrigation availability:

The situation is totally opposite in term of actual distribution in the field. The Joyianwala Distributary did not receive the amount of water which was allocated before the commencement of the season. Table 3 shows the picture of the months April and May, 2016. It is clear that for 1st ten days of April, 2016 Joyianwala Distributary was entitled for 2 cusecs but it received nothing, for 2nd ten days of April, 2016 it was entitled for almost 3 cusecs but it got nothing (closed). From 11th to 20th May, it was entitled for 8.28 cusecs but received nothing. Moreover, the last column of Balance is showing that Joyianwala Distributary did not use any water of its share up till now in terms of volume and the balance is the same as was original entitlement i.e. 3.249 (1000 AF).

Table 3. TENTATIVE AND ACTUAL DISTRIBUTION PROGRAMME KHARIF 2016. Total Share (1000 AF) = 3.249							
Start Date	End Date	Entitlement (Cusecs)	Deliveries (Cusecs)	Difference (Cusecs)	Deliveries (1000 AF)	Acc. Deliveries (1000 AF)	Balance (1000 AF)
1/4/2016	30/9/2016						
1/4/2016	10/4/2016	2.070	0.000	-2.07	0	0.0000	3.2490
11/4/2016	20/4/2016	2.990	0.000	-2.99	0	0.0000	3.2490
21/4/2016	30/4/2016	5.060	0.000	-5.06	0	0.0000	3.2490
1/5/2016	10/5/2016	8.050	0.000	-8.05	0	0.0000	3.2490
11/5/2016	20/5/2016	8.280	0.000	-8.28	0	0.0000	3.2490
21/5/2016	31/5/2016	9.200					
1/6/2016	10/6/2016	10.120					
11/6/2016	20/6/2016	10.350					
21/6/2016	30/6/2016	10.810					
1/7/2016	10/7/2016	10.810					
11/7/2016	20/7/2016	10.120					
21/7/2016	31/7/2016	10.120					
1/8/2016	10/8/2016	10.120					
11/8/2016	20/8/2016	10.120					
21/8/2016	31/8/2016	10.810					
1/9/2016	10/9/2016	10.810					
11/9/2016	20/9/2016	10.810					
21/9/2016	30/9/2016	10.810					

3.4 Issue of Water Quality

As per assessment by Intercooperation (March, 2016), it was found that 20 years back, the water quantity was sufficient but now it only fulfils 20% needs of the farmers. Similarly, the draw down in ground water table is found by 15-20 feet per annum, which is also clear from the fact that government has abandoned SCARP tube wells meant to improve the water logged area/removesaline water. All the tube wells, pressure & hand pumps at household level are also functional. Moreover, the quality of canal water is good for irrigation while the quality of tube wells water is not good if it is shallow.

Usually, beneficiaries come together on announcement from mosque to clean water course in the beginning of the season. The cleaning of the minor is the responsibility of government butitisdeaned once in two or three years which is mainly depend upon the availability of fund. The less interest of the Government to maintain this minor may be due to following factors:

- This is seasonal minor-canal (means supply water for only Kharif season)
- The area is flood prone; therefore, the government may be investing less on improving the water infrastructure
- Easy to install tube well and use ground water for irrigation. Initially the farmers were also preferring to use tube wells for irrigation as the electricity was subsidized

The water tariff is very low and farmers pay Rs.180-200 per season for water to irrigate 1 acre of land. In case of good rains, they don't apply water to their crops but there is no surplus water to grow more land or sell it to other farmers especially from canal.

4. Key interventions to address main water issues

This chapter provides details of the activities mentioned in the action plan. Lead roles and support roles for implementation of these activities have been outlined in the action plan.

4.1 Good governance of water

Good governance of water refers to equitable water distribution guided by a transparent system and where system breach is considered an act for which people are held accountable. One of the most important symptom of bad water governance is multiple water disputes that continue to linger on without being properly settled. Usually these disputes emerge due to shortage of water. A good water governance regime is based on efficient water utilization which leaves space for multiple water objectives and for a broader set of stakeholders. Unfortunately, the project area has not been lucky in terms of good water governance. Institutional erosion, inequitable access to water, lack of accountability and transparency, limited culture of community participation and weak enforcement of laws have been the main factors for poor governance. The following options are suggested to improve the governance of water in the planned area:

a) ***Mobilising farmers into water users' associations (WUA):*** *Formation of WUA* will be piloted with RPL contractual farmers by using the incentives tool (pull factor). The objective of the formation of WUA is to promote collective action for sustainable production particularly with respect to productive use of water. The WUA will help farmers' and other actors in introduction smart monitoring tool, best agronomic practices (DSR, AWD, increasing plant population per unit area), use of technology (laser leveling) and dissemination of results from water efficient practices.

b) ***Registration of water user association.*** The WUA will be registered with the OFWM under 1981 Act. Registration of WUA is important to benefits from government's ongoing schemes. The government provides 60% support to farmers for improvement of water courses. The farmers have to share 40% of the expenses. Registration will provide legitimacy to WUA for accessing such support and to improve operation & maintenance of the water courses.

c) ***Capacity building measures including linkages:*** The WUA will need capacity building to run the associations. This will include trainings on basic book keeping and management, water theft and conflict resolution, awareness on benefits of efficient irrigation, training of master trainers in water saving technologies (e.g. DSR, land leveling), transplanting with prescribed distances. The WUA will be linked with all the concerned stakeholders including Pakistan Meteorological Department (PMD), relevant government line agencies, market players and service providers.

d) ***Generating savings:*** Saving with the WUA will be very crucial for management of the WUA and maintaining of the water courses. The WUA will be supported to generate saving by its members and any other sources. The saving will be kept in a joint account operated by officials of the WUA authorised by its members. The members can contribute to the savings from sale of rice sale.

- This saving can help WUA contribute their own share in the improvement of water channels
- This saving can be used for internal lending for the purchase of inputs
- This can also assist in contributing for the sustainability of the WUA

4.2 Maintaining Sustainable water balance (Water Use Efficiency Aspects)

The major concerns regarding performance of irrigated agriculture are low crop yields, water losses and low water use efficiencies. In addition to water shortage, lack of inputs, poor irrigation practices and soil salinity & sodicity are the major factors for low crop yields. Low water use efficiencies have led to reduction in crop yields (an overall reduction of 25% in overall agricultural productivity). Therefore, it is necessary to work on to increase the productivity of water for increasing per unit yield of the agriculture crops. The following methods are suggested to attain high water efficiency.

A. Land levelling:

Land levelling using laser levelling equipment which will save 20% to 30% of water. Laser leveling is not a onetime activity as after second harvest the farm levels tend to change, therefore every preparation for rice cultivation should entail setting up of field levels for optimum production.

B. Technology Development (Research activities):

The Rice Research Institute at Kala Shah Kaku is engaged in conducting research on water efficiency aspects of rice production. Some of the techniques introduced by the institute that will be applied in the project area include:

- **Direct seeding of Rice (DSR):** The method of sowing has not been widely used. It can be applied through broad cast, drill and bed or furrow irrigation methods. This technique will ensure high level of water productivity up to 30% and also reduce labour requirements up to 70%. Rice cultivation can also be successfully carried out using a seed drill in both moist and dry fields. In dry fields, irrigation should begin as soon as possible after sowing. Basal fertilizer can also be added through the seed drill. In a perfectly levelled field, plant establishment rates should be between 40-50% of seed sown. It is assessed that direct seeding increases weeding hassle which means that direct seeding requires an extra management of weed control.
- **Water efficient varieties:** Test and asses results: with the support of test and assess water efficient variety of rice for cultivation in future and dissemination.
- **Alternate wetting and drying (AWD):** In this method field is alternatively flooded and non-flooded, specifically it is flooded one week before to one week after the flowering of the field. It can save the water use up to 15%.

C. Dissemination of water efficient techniques:

- Awareness material on water efficient practices through extension and print media.
- Awareness campaign will be run through media (e.g. radio)

D. New and improvement of water courses:

This may include suggestions for scheduling irrigation as per actual crop water requirements and preparation of area wise plans of irrigation/monitoring.

- Meetings will be conducted with area farmers on improved irrigation management through need based rotation.
- Developing a system with the help of farmers and WUA for cleaning of water courses before and after the rice season or at intervals necessary to maintain the water courses in good

condition. Training for operation and maintenance will be imparted by technical staff of the government.

- Rehabilitate, lining and improve water courses including canals, distributaries and minors
- Cleaning of water courses through farmers' participation

4.3 Policy advocacy and regulatory issues

The Joyianwala experience will hopefully be of high value for policy dialogue on key issues relatedto irrigation efficiency in the entire rice growing area.

a. **Rotation system:** Warabandi must be well documented and seminars may be conducted for the same for a clearer understanding, and periodic review of Warabandi.

b. ***Assessment of groundwater***: There is a huge gap on information regarding groundwater. There is a need for a baseline on where does groundwater stand today and what thekeyissues to address are. At the moment, groundwater is a subject that has no home within any department. However, farming community needs to be aware of the continuous depletionof groundwater. This may be done through;
   - Conducting assessment of groundwater of the areas (its current status and future projections)
   - Disseminating research findings to the farming community

c. **Issue of water theft:** Water theft control committees have been established by Irrigation Department, Government of Punjab in May, 2014. The committee is comprised of three (3) members i.e. 1. Assistant Commissioner 2. Sub divisional officer of the irrigation department and 3. SHO of the concerned police station. In case of any offence, the committee send the report to the concerned DCO (District Coordination Officer) who is also responsible foroverall monitoring and supervision of the exercise. Farmers, however do not have information that such committees exist and how to approach them.

d. **Economic of water and cost saving techniques:** The main objectives of the intervention is to establish the baseline against the economic indicators once rice seasons (before cultivation and after harvest) and to prepare the analysis sheet showing which factors (indicators) are contributing how much in water productivity of rice value chain while calculating net income per unit of land. In order to achieve the said result, one has to calculate the economics per unit of (samples) rice farmers within the project stipulated period of time and to show as successful business case/model to rice farmers other than the project areas. This studywillbe the part of a larger monitoring framework we have prepared for WAPRO which is aimed at systematically choosing 21 farmers in the area. The results of the study would enable WAPRO to convince the concerned stakeholders including policy level to replicate in the areas other than the project areas. Annex 4 shows the detail methodology of the concept.

e. **Policy Seminar on irrigation in Punjab:** Conduct a study on currently in vogue irrigation systems including feasibility of lining the channels. The study will also identify areas where irrigation water is short and areas where irrigation needs improvement for efficiency. The finding will be shared in a seminar/workshop with an objective to identify what to do to improve a century old irrigation network in Punjab and its improved governance, taking a departure from WAPRO and other similar initiatives' success

4.4 Improvement of Water Quality (contribute to healthy water)

A. Awareness on quality of water

The overall drinking water quality of the area is not appropriate and healthy. This results into variety of health related problems which is also confirmed by the gender assessment of the areas as well. Overall health and hygiene condition was marginally satisfactory in the area. There were serious concerns regarding health facilities. Hepatitis and Cholera are among the common problems. The reason behind this issue is the use of dirty water. In most of the areas the water is not safe fordrinking. 70% of the women respondents said that they were also facing diarrhoea, scabies, allergies, TB, sun stroke, goitre issues. Kidney problems were also reported by 4% of the women. 30% of the respondents were aware of the advantages of boiling water however they felt helpless due to unavailability of gas facility, which prevents them from doing so10. Although the project isnotdirectly dealt with improvement of health related problems, however, efforts regarding awareness raising regarding precautionary measures of dealing with un-hygienic water is suggested. In addition to this the dissemination of the results of the study findings of "ground water depletion" will also play an important role in sensitizing the water related concerns to the communities.

B. Development of Education Materials

Education materials play an important role in disseminating of information and up-scaling of technology among the farming community. There is a lot of education materials exist in the project areas including best agriculture practices, technology innovation and value addition. However,these are mostly meant for academic purposes. Farming community, which is mostly illiterate, is not aware of the benefits of such materials. Moreover, the education materials are not public and mostly in scattered form. There is need to translate all those education materials in simple and local language so that real benefits, particularly related to water efficiency, could be achieved. The followingmaterial exist in hard form with various rice research institutions, irrigation department, OFWM, RPL etc.

Existing Materials:

- Varietal information of different rice varieties.
- Nursery raising techniques
- Reduction in plant height
- Direct seeding of Rice
- Use of laser levelling technologies
- Value addition techniques and processes (Rice brain oil)
- RPL Rice Check Programme (manual for best agriculture practices)

Required Materials:

- Translation of the above mentioned existing materials into Urdu language
- Promotion martials (pictorial) for showing water savings practices
- Use of environmentally safety measures for producing good quality rice
- Manual for master trainers regarding service delivery
- Situation of ground water and installation of tube wells (After conducting study of ground water situation)

C. Up Scaling of existing model

Efforts will be carried out for replicating and up scaling of existing WAPRO model first in the areas around Joyianwala minor and then to other rice producing areas, if results are successful. As private sector is the main driving force behind the whole project, therefore, their involvementwillbeensured through disseminating the project impact through holding seminars and workshops. Rice export association of Pakistan (REAP), who has 800+ members in their organization, would be contacted in

[10] Nizami, T; Qazi, S and Hina, S. (2016), Gender Study in Rice Value Chain, Pakistan, Intercooperation, Pakistan.

this regard. Besides the other market players including commission agents (*Arthies*) will also be involved in the whole process of sensitization of promoting water productivity. In the first stage the market players of Muridke will be approached and later on to the others players of the whole District Sheikhupura. The following are some of the crucial and aimed market players which will be reached out during plan period.

4.5 Relevance of the Plan

This plan is valid for the period of 2017-2019:

Overall area covered under the plan	
Total population coverage	7 villages (30-35,000)
Total number of households integrated in the plan	6,000-7,000 hh (with average 5 person per hh)
Number of farmers living in the Joyianwalabasin	2,500 to 3,000 farmers
Total acreage of land within the minor Joyianwala	5,390 acres
Cropping system currently prevalent in the area	Wheat-Rice-Fodder
Total estimated cost of the plan	Rs. 62.61million (US$ 0.5940 million)
Total RPL staff responsible for this area	6
Total OFWM staff appointed in the area	Nil
Total irrigation department staff appointed in the area	8 (1 SDO, 1 sub-engineer, 1 Zialadar[11], 1 Patwari, 4 baildars

From the view of up-scaling, the idea is to pursue mainstreaming water productivity concept in the government but also disseminate the idea to other private sector actors in rice. Some of the identified ones include:

List of other private sector in Muridke

Market Players	Location	Coverage districts	Approximate number of farmers
RPL	Muridke	Sheikhupura, Gujranwala, Hafizabad, Mandi Bahaudin, Narang Mandi, Narowal, Badho Malhi, Sialkot, Jhang	500+ Farmers
Engro	Muridke	Sheikhupura, Michnabad	200 Farmers and 300 Dealers (Commission Agents)
REAP (Rice Export Association of Pakistan)	Lahore	All Rice-growing Districts of Pakistan	unlimited
Reem Rice Co	Muridke	Sheikhupura, Gujranwala, Narowal	Procurement through commission agents

[11] *Supervisor of Patwari (1 Zialadar has 8-10 Patwaris)*

4.6 Action plan

Key Activities	What (Activity)	Where (location	Quantity	Possible roles	When (timeframe)
5.1 Improved water governance					
5.1. a) Mobilizing farmers into Water Users Association (WUA)	• Mobilize farmers during regular interactions and convince on WUA idea • Meetings with the interested farmers (WUA formed) • Preparation of bylaws for WUG (ToRs) • Establishment of WUA linkages with input suppliers and companies	Joyianwala Minor/13 outlets	1	RPL/Growers/IC	2017
5.1 b) Registration of WUA with OFWM (under 1981 Act)	• Facilitate in registration with OFWM	Joyianwala	1	RPL/WUA supported by OFWM	2017
5.1 c) Capacity building measures	• Institutional development of WUA • Awareness on irrigation management (and procedure to follow in case of water theft) • Engaging WUA identified master trainers in technological skill training (water saving practices, transplanting techniques in DSR etc.) • Ensure dissemination of awareness material to WUA	Joyianwala	Approximately 15 training events and follow ups	RPL/WUA/technical trainers (government and RPL), Irrigation department, OFWM, IC	2017-2018
***5.1 d)* Saving generation**	Convince WUA is to set aside some portion of their income from rice sale for their own functioning, theft damage repair and communication	Joyianwala	As per WUA	Mobilized by RPL WUA members	2018
Proposed Indicators of progress	1. # Awareness sessions to sensitize farmers for WUA formation and WUA formed 2. # Sessions held with farmers/association through "water theft control committees" regarding water use, its control etc. 3. # farmers sensitized on water saving practices and # of farmers actually practicing these 4. Improved O&M of channels 5. Evidence on use of surplus water 6. Authorities' interaction with WUA, registration of WUA 7. # of events of water theft reduced 8. Water theft control committees' endorsed / implemented # of their decisions.				

Key Activities	What (Activity)	Where (location	Quantity	Possible roles	When (timeframe)
5.2 Maintaining Sustainable water balance (Water Use Efficiency Aspects) based on a few interventions already taken up in 2016					
5.2 A) Land Levelling	Laser land levelling	Muridke, Gujranwala & Sheikhupura	8000 acres	Lead role: RPL on cost sharing basis with farmers Supportive Role: OFWM (training, servcies on demand)	2017 2018
5.2. B) Technology Development	Direct Seeded Rice(DSR)	Muridke, Gujranwala & Sheikhupura	8000 acres	Lead role: RPL Supportive Role: Agri. Extension (any advice if needed and join field days organized by RPL and farmers)	2017, 2018
	Water efficient varieties – test and assess results	Muridke, Gujranwala & Sheikhupura	5	Lead Role: RRI Supportive Role: RPL will privite cotarctual farmers for demonstrating new water efficient varieties	2016-2017
	Alternate Wetting & Drying (AWD)	Muridke	2016: 10,000 acres 2017: 5,000 acres	Lead Role: RPL Supportive Role: Agriculture Extension & Farmesr (advice and join field days organized by RPL and farmers)	2016, 2017
5.2. C) Dissemination of techniques	Awareness on water efficient practices through extension material, print media and radio	Muridke, Gujranwala & Sheikhupura	3000	Lead Role: RPL Supportive Role: IC	2017-2018
5.2 D) Development of water courses	Rehabilitate, line, and improve canals, distributaries, minors and watercourses	Muridke, Gujranwala & Sheikhupura	13	Lead role: OFWM (public budgets for water course maintenance) Supportive Role: Farmers (cost sharing)	2017-2018
Collective water course operation & maintenance system establishment (GG)	Engagements of growers in water course cleaning after 2 months	Joyianwala	13	Lead Role: RPL and farmers Supportive Role: Irrigation Department	2017

Preparation of Area wise plan of irrigation / Monitoring	Meetings with area farmers (improved irrigation management through need based rotation – an improved version of warabandi) Training by technical Govt. staff	Joyianwala Minor/13 outlets	10 trainings	Lead role: Irrigation Department Supportive Role: RPL / On farm Management	Nov-2017-2018
Proposed Indicators of progress	# Farmers using water efficient technologies on their own decision and without project support. # Water courses improved collectively and individually by the farmers. Head, mid and tail farmers equitably receive water (general feedback) The surplus water left for the downstream farmers. Net income of farmers enhanced (economic analysis) Clear evidence of water saved (data, analysis)				

Key Activities	What (Activity)	Where (location	Quantity	Possible roles	Time frame
5.3 Water policy advocacy and regulatory areas					
a) Rotation system	• Document Warabandi system. What is it and how this works at the moment (also include nomenclature of terms used in irrigation).	Joyianwala	3-6	RPL + H Peer read by OFWM	2017
b) Ground water Assessment	• Groundwater study in Muridke: Quality of water, quantity of water extracted, number of wells and extrapolate trend (collaborate with groundwater assessment platform)	Muridke, Sheikhupura	1 study	H with support from PMIU and RPL in collaboration with Irrigation Research	2017-18
c) Issue of water theft	• Map where theft is chronic, actors and means • Linking water user associations with water theft committee (chaired by Assistant Commissioner) • Making the water theft committee known in the catchment for farmers' access • Smart Monitoring – training of selected farmers • Smart monitoring – propose confidentiality of informant	Sheikhupura district (specific) All over Punjab (impact of info)	1 Tehsil with impact on canal irrigated area	RPL with H+ PMIU + District Admin + Farmers	2017-2019

d) Economics of water and cost saving techniques	• Select farmers for the study and stay consistent with them • Conduct their economic socio-profile • Conduct economic analysis of water saving techniques • Prepare messages (also time, fuel saved etc.)	Muridke	21	Study: H with RPL And consultants Messages on techniques: Led by RPL with H and OFWM as peer reviewers	2017-2018
e) A policy seminar on Punjab irrigation canal system today – challenges and future in view of changing context	• Joyianwala example: Complete network of minor and water courses, feasibility study for lining and implication. Identify areas where shortage of water occurs and reasons	Joyianwala	One study	Irrigation Department. Research wing	2017
	• Use the study to conduct a national seminar or policy workshop – also share best practices introduced by WAPRO	National	200 participants 1 day	H with PMIU + RPL (joint seminar)	2018
Proposed Indicators of progress	1. # documents (peer reviewed and authenticated) available: Warabandi system, groundwater study, Joyianwala canal system efficiency 2. Findings of the study shared with the concerned authorities and other stakeholders 3. # WUAs and # theft committees closely interacting with each other on the issue and # cases of water theft reduced. 4. # Issues identified and shared with relevant authorities and possible measures taken by the concerned stakeholders 5. National seminar / workshop highlights key issues, brings consensus and brings WAPRO achievement under spotlight for replication 6. Collaboration with multiple stakeholders mobilized / enhanced for good support and a wider dissemination of messages and best practices				

Key Activities	What (Activity)	Where (location	Quantity	Possible roles	When (time frame)
5.4 Water quality and awareness raising					
Awareness Raising on quality of water	• Sensitizing communities about precautionary measures of using un- hygienic water. • Dissemination of "groundwater depletion" study among the concerned stakeholders	Muridke & Joyianwala	In regular field interaction with communities Display at key places	RPL	2017-2018
Development of Education Materials	• Translation of the existing materials into Urdu language. • Promotion martial (pictorial) for showing water savings practices (urdu) in Urdu.	Muridke & Joyianwala	Different Extension Materials produced by RPL, OFWM and new	H + RPL	2017-2019

	• Situation of groundwater and installation of tube wells (after conducting study of ground water situation)				
Up-scaling of Existing Model	• Workshop with other Rice millers and buyers (using network of REAP) • Field days and awareness for Government Extension workers • Dissemination of knowledge and results through media	Muridke & Joyianwala	Workshops and seminars	RPL and H	2018
Proposed Indicators of progress	1. Approximate # farming families adopting precautionary measures on drinking water. 2. Approximate # Farmers realize the negative impact of their agronomic practices on pollution of groundwater (which they eventually drink). 3. # awareness raising material disseminated and used by farmers (random feedback) 4. # of REAP members sensitized and # showing commitment to disseminate and replicate good practices with their farmers 5. At least one additional resource captured for up-scaling WAPRO experience				

Indicative cost for the above activities (Potential contributing stakeholders including Farmers, RPL, IC, Irrigation department, OFWM, other interested donors)	
Total Estimated Cost for **Improved Water Governance**	5,000,000
Total Estimated Cost for **Maintaining sustainable water balance**	60,000,000
Total Estimated Cost for **Water policy advocacy and regulatory areas**	4,500,000
Total Estimated Cost for **Water quality and awareness raising**	500,000
Total Estimated Cost	**70 million***

*Detailed costing of individual interventions can be conducted in real time when required or demanded.

5. Expected Results other than the increase of water productivity:

The implementation of the action plan will not only achieve the water productivity in rice value chain but also has the following expectation in terms of the following important areas;

5.1 ***Stakeholders' roles – what may improve:*** Looking into the stakeholders' map, it is clear that there is a need to strengthen the role of the following stakeholders as the process for implementation of water use management plan continues:

- Women have an immense contribution in rice transplanting. Their quality of life needs to be improved as water efficiency in rice production increases. This includes training them on optimal transplanting technique (number of plants per acre and so on), opening doors for other sources of income from land once Joyianwala gradually switches to DSR, improving health facilities and even providing education facilities to young girls. This will turn them into a more interested and less marginalized stakeholder in rice value chain in the area.
- Relevant Government departments. At the moment categorized in low interest category, we hope that a shift will be made to a high interest category and lots of support will come to Joyianwala from OFWM, Irrigation and Research players.
- Farmers from their low influence category will gradually move closer to a high influence category and will have a collective voice to make a difference in improved water management for crops.
- Master trainers currently prepared by RPL do not show anywhere on the map as yet. They will create their space and provide meaningful support in the long run in disseminating new techniques.
- Researchers – not only Rice Research Institute – but also university researchers, will find Joyianwala area interesting for their studies; more visibility, and high chances of replication and up scaling; some of the research will be internally driven by RPL and partners, e.g. on economics of water use efficiency, so that validated conclusions may be given to the policy makers and farmers from neighboring areas.
- Federal Seed Certification and Registration Department at the moment is included in the map but has no well-defined role. This needs to be further explored as we move into exploring more water efficient but market favored varieties.

5.2 Strengthening institutions:

The number of following formal and informal institutions in the project areas will be strengthened as a result of the various interventions.

1. Formation of Informal association of rice growers – supported by Irrigation Department
2. Area wise plan of irrigation monitoring (flow measuring at peak Kharif season)
3. Awareness raising of farmers on various issues through participatory (PTD / FFS)
4. Collective water course operation and maintenance system
5. Mobile company based system for info distribution (e.g. weather)
6. Linkage with Pakistan Meteorological Department (PMD)
7. RPL networking with relevant stakeholders
8. Informal association needs to be linked with RPL facilitated weather information distribution system
9. On farm water management trials
10. Behaviour change – on farm training sessions, schools

6. Implementation and Monitoring Strategy

The following are the main areas of interventions in the above mentioned action plan;

- Promoting good governance in water management combining water equity, environmental safety and economic presperity
- Maintaining sustainable water balance
- Important water related areas (IWRA) that contribute to policy and regulation related aspects
- Improve water quality (contribute to healthy water)

The implementation of the plan will be carried out as per project document of the WAPRO project. Private sector partner RPL, which is responsible for push and pull components of the project, is already engaged with contracted farmers and is working on ensuring sustainable water balance. This sustainable water balance is ensured through introducing water use efficiency aspects including best agriculture practices and technologies. Whereas, the issues of policy related elements will be implemented by HELVETAS Swiss Intercooperation. These issues include the aspects of groundwater monitoring, lobbying for compliance regarding maintenance of channels, awareness raising regarding water theft control committees, promotion of education materials and up-scaling of successful cases regarding water use efficiency to the areas other than project areas. Government actors such as Punjab Irrigation Department, On Farm Water Management, Rice Research Institute Kala Shah Kaku, etc. will play the role of service providers in implementing the technical aspects of the projects. They will be linked with beneficiaries on need basis and provide relevant advice and services. Financial institutions such as banks and microfinance institutions are to be involved at the stage when the whole business model of WAPRO project becomes feasible and profitable. The study of 21 sample farmers during the project period, a test case for the sound business models, will be a tremendous tool for the financial institutions and others private sectors to invest. In the first three years of the project (2016-2018), efforts are being made to link all the essential missing links at operational, service provision and policy levels. Up-scaling and replication of the WAPRO model will be done in the 2nd phase of the project (2018 onwards) through the involvement of REAP (Rice export association) with the like-minded companies for sustaining the pull and push factors of the project.

Regular internal monitoring is conducted by

(i) RPL through maintaining monitoring database of activities
(ii) Regular meetings of the team for discussing qualitative aspects of the plan implementation, processes and obstacles.

Another major intervention in monitoring will be documenting farmers' cases as benchmarks with respect to farmers' current level of water use and various agriculture inputs that result in yield and net outcomes. Their conditions will be evaluated/analysed at the end of pre-planned key interventions related to their impact with particular focus on water productivity. The successful cases will be used to replicate in non RPL areas for up scaling purposes. **Annex 4** gives a concept note in this regard which will be followed up for this purpose. At the end, the main field of change is water use efficiency without compromising economic and social wellbeing objectives of the farmers and without harming rice procurement targets of private sector player. When this is achieved, we believe that the case of water use efficiency will be a sustainable and replicable one after the project is over.

Annex-1: Summary of baseline Study

- **Crop rotation:** In the four countries 78% of farmers practice crop rotations. In all applied crop rotation schemes rice is taking significant percentages of the acreage.

- **Irrigation area:** 70% of rice areas are irrigated, whereas only 48 - 65% of the production area of other crops in the crop rotation schemes is irrigated.

- **Duration of irrigation:** The number of irrigation days is significantly higher for rice (51-60days), compared to 0-3 days for other crops.

- **Perceived problems:** Farmers mention the following problems regarding to irrigation:
  1) Bad condition and maintenance of irrigation channels,
  2) Lack of specialist for irrigation infrastructure,
  3) No proper levelling of rice fields,
  4) High costs of water due to high energy consumption,
  5) Timing of water availability for irrigation does not fit farmers' requirements,
  6) Lack of local leadership to facilitate fair distribution.

- **Food availability from own production**:
  - In Pakistan the opposite is the case: farmers claim to have enough food from own production for their family needs during 12 months.

- **Net income:** Farmers earn in average USD 12,380 from rice production.

- **Involvement in decision making:** Very few farmers participate in such processes. But even if farmers are involved there are neither Water Use Management Plans that are followed nor is the adjacent population involved.

- **Payment for water:** Almost 100% of farmers are paying somehow for water, but due to subsidies and in transparent models this does not translate into incentives for increased water productivity.

- **Participation in trainings:** The majority of the farmers did never participate in a water related training (57% - 100%). Those who participated got the trainings from NGOs or government departments.

- **Awareness about water policies:** Only 2% of the farmers indicate that they know any water related policy.

- **Policies:** National laws and policies for irrigation water exist and water is controlled centrally nevertheless the interviewed stakeholders did not mention any measure or policy that addresses water productivity.

Annex-2: Summary of study on role of women

In Muridke area of Sheikhupura, a study was conducted to assess role of women in rice value chain. For this purpose, women in traditional labour community and key informants among farmers and RPL staff were interviewed. Two types of areas were selected – the areas where the best practices are being applied, tested and implemented by contracted farmers of RPL, and areas with non RPL clients/farmers who are still attached with the traditional farming technologies.

Women are mainly involved in the transplantation and are the most neglected segment in the rice value chain. They are involved in rice transplantation for approximately 45 days' time span on millions of acres in the province Punjab, Pakistan. There has been enormous pressure; not only for the women transplantation workers to cover the required area but also for all the rice farmers to ensure timely rice transplantation to secure optimum rice yield.

This work however poses significant health hazards for the women involved. With reference to the women's contribution as transplantation workers, it was found that this task is highly demanding and tough, but on the other hand better paid than other temporary jobs available due to two reasons: There is a shortage of labour for this particular work; and transplanting is a specialised task and not everyone can do this.

By adopting new sowing methods and production technology i.e. DSR, AWD and laser levelling techniques, the nature of labour requirement may change and experts need to work out how women could be involved in rice value chain in the future. In case farmers opt to switch to dry seeding technique, transplanting will come to an end and women will not be needed anymore. However, adoption of DSR will not happen overnight. The transition from current transplanting techniques to the new DSR technique will be gradual. This means that women will not be out of work immediately from the entire rice producing areas. Some of the fields will apply DSR and it is expected that every year some more will join the circle. Women therefore will continue to offer labour and gradually will have time to switch to other options as demand for labour for transplanting diminishes. On the other hand, there is sufficient time to introduce new skills for new occupations, including relatively specialized ones in the industrial units for literate young women. Interviews also reveal that there is a fair chance for women to be engaged in weeding as a new alternative for women's role in the rice value chain.

Rice crop is one part of the household income; and since transplanting will remain in demand during the coming years, it can be deduced that in case women completely lose this source of income in few years, there will be no significant reduction in income for the whole family since this loss may be compensated by new income alternatives, some of which are already in line; i.e. working on brick factories (*Bhattas*), collecting strawberries or peas etc. Also the better margin earned from transplanting is often diverted to fixing their health issues, sometimes due to transplanting itself. Other decent possibilities for additional income generation like crafts and livestock rising may also be evaluated.

Most women interviewed showed a great interest in improving their lives and income but they were especially keen on improving their daughter's lives. They wish to see their girls in high schools for better education and for themselves adult / functional literacy and trainings in other new skills.

The study in 17 villages has shown that the participation of women in decision making is very low and domestic violence is high. Therefore, it is recommended that an effective strategy may be defined leading to more economically empowered women in the community. The encouraging aspect noted in all interviews was that the women are used to hard work and are interested in continuing to earn an income, to become functionally educated and seek other sources of income and possibilities.

Annex-3: Assessment of Joyianwala Minor – Distributary Sikhanwala, Upper Chenab – Ravi Link Canal

March 2016

The meeting was held with RPL representative in the evening before the day of field visit. A plan of the field was shared with him based on the information of the area. During the meeting it was decided that a team will visit to carry the assessment according to the following schedule.

S. NO	Date	Activity	Remarks
1	13.3.2016	Visit to village Saikhum	A joint team visited both villages and conducted 3 meetings with a group of mix (RPL contractual & non contractual) farmers groups.
2		Visit to village Joyianwala at up stream	
3	14.3.20016	Visit to 2 villages at down stream	Two team visited village Kathiawala and conducted meetings with 2 farmers groups at the tail end of Minor in the morning.
4		Visit to 2 villages at midstream	A team was divided in to two and visited 2 villages of Saikhum and Chack Sanatha at mid-stream in the afternoon.
5	15.3.2016	Compilation of report	Jointly with team members from RPL

Meeting at villages of up-stream, mid-stream and downstream of minor Saikhum:

- ***Introduction to Minor Saikhum***

The Saikhum minor is extended over an area of 8-10 KM length supplying water for irrigation to 9 villages. The minor is extended/ located at the head of distributary Saikhum and the team visited 6 villages out of the 8 villages that get water for irrigation from this minor. The minor is totally unlined and thus up to 50% water got lost reaching from the head to tail as per farmers' perception at different location (Needs a mention of losses separately in the minor as major issue and in the water courses as lesser of the issue. The total number of Mogas that supply water for irrigation is about 13. The total house hold of the 5 village is **about 2136**. Few villages of this are prone to floods in summer from Nallah Dek at different times and in 2015 (last year) in spring, the area was hit by heavy flood.

Assessment in the villages:

- ***Land holding in the area***

The total land of the villages under Joyianwala minor is about 5,390 acres as per revenue record of the area. The land is of good quality and irrigated though previously this was water logged area and tube wells were installed by the government for the purpose of salinity control and reclamation. Majority of the households are small farmers having land less than 12.5 acres of land. The average land holding of the farmers are given below in the table that show a trend that majority of the farmers small having land less than 12.5 acre (as per government criteria). Most of the farmers are self-growing and very few farmers leased their land either to tenants or leased from others. It is observed that land holding is directly link to the livestock keeping as those HH having no land doesn't keep livestock. General every HH keep large livestock like buffaloes for milk production and sell it in Lahore market and also for their own consumption.

S. No		Land holding category	No. of HH With Landholding	No. of HH without Landholding (including tenants)	Total
1	HH with/without landholding	0		832	
2		1-3	320		
3		4-6	257		
4		7-9	212		
5		10 and above	486		
		Total	1275	832	2107

Major issues of the villages in area

- ***Social Sector Related Issues:***

In the social sector, the major issue of the villages is drinking water followed by water borne diseases told by the farmers due to bad quality of water. The villagers' ranked 1st priority (5 marks) DWS as there is no government schemes in the villages and the tube wells installed at depth less than 200 feet are not fit for drinking due to colour. Sanitation, health was ranked 2nd (4 marks) as due to bad water quality, this cause different diseases and there is no health facility in the villages. People of the villages travel long distance (5-7 km) to get health facility for minor diseases. Similarly, education, electricity load shedding with high fluctuation of voltage and transportation they ranked 3rd (3 marks). There is no middle and high schools either for boys or girls in majority of the villages and farm to market road is also not in good condition.

Overall, the different villages' people ranked differently their social sector issues but all these issues exist in all villages. As a team we observed that drinking water supply in these villages by the government is negligible. Similarly, health and education situation is also not good as no basic health facilities exist in few villages that we visited. Electricity issue also mentioned by the farmers that low voltage, long duration load shedding and high cost affect our irrigation capacity as most of the land we irrigate from the tube wells that run by electricity. Farm to market roads are also not very good but farmers don't consider it a serious issue as they transport their produce either way. Certain hopeful situations observed regarding drinking water is bores drilled close to the main link canal gives sweet water or bore extended below 220 feet deep. Drainage of rain water, waste disposal and lack of sewerage system is badly contaminating those pressure pumps/ tube wells having depth less than 45 feet bores (this is sub surface water of poor quality) where majority of HH are pumping water for drinking purpose.

- ***Irrigation Related Issues:***

The villages have only water for irrigation in summer (Kharif) season and they grow rice crop of duration from 4-6 months. Though the water quantity for irrigation is not sufficient from canal and they supplement with the water from tube wells run by either electricity or diesel. It was mentioned by the farmers both RPL and non RPL in up-stream that in their villages, there is no water theft while at downstream farmers mentioned that up-stream farmers' theft their water at the time of sowing. They mentioned that within villages, if someone need more water, he asks the other neighbour farmer to get his time or use his tube well to which they pay. Similarly, there is no dispute on water, if some minor dispute arises, they solve it at local village level. The major concern of the farmers is the cost of electricity and fuel. It was mentioned that monthly electricity cost is high as up to 20000 Rupees while in case of diesel, it goes up to 40000 when the season is dry. The farmers mentioned that the size of the moga is small and the discharge is not sufficient to irrigate the whole land of the villages therefore we use tube well.

- To me the cost mentioned by the farmers are on a very high side and actually it may be less.

All the five villages that we visited during the two days have issue of water shortage from canal. In all villages, farmers mentioned that they largely use tube wells to supplement irrigation water for irrigating their field. As, at the movement, the minor was dry because this area has only water right for irrigation in summer (Kharif) season, therefore it will be a high time in summer to know about the exact contribution of canal and tube wells. My observation is that about the quantity of water supplied from tube wells mentioned by the farmers looks exaggerated but it is confirmed that they use tube wells. Farmers of the villages at mid-stream and downstream mentioned that villages at up-stream theft their water at the time of rice sowing when we are in dire need of water. This also result some time in dispute but the dispute remains only to the limit of "Mu- Mari' not a physical dispute and we resolve through bilateral dialogues by village elders. It was mentioned that we don't have such disputes on water that are resolved through courts or result in injuries. The farmers at mid-stream mentioned that farmers of Joyianwala at up-stream are more influential and they theft water mostly at the time of sowing.

- **Overall our observation is that farmers were hiding information especially about the quantity of water availability in the minor and water course and also information about electricity bills.** Experience in water efficiency is farfetched currently, further real awareness on real picture at villages level, irrigation water availability on document and actually as experienced is lacking at village level. Further monitoring of water losses and effective solution mechanism seems ineffective at department level.

Observation:

- The minor was designed at the time back when most of the land was fallow and water logged. Thus quantity of water as per design is less compared to the command area now.
- The ground water table is shallow and farmers can easily install tube by investing little money that might be the reason of less attention of department to the irrigation system from canal.
- Few years back, the electricity supply to agriculture tube wells was subsidized by the government as a policy, therefore it might be prefer by the farmers to have their own tube well rather to be depend upon canal water. But now the cost of electricity is very high and farmers feel that they can't afford the bills and asking for more water in the canal.

- ***Agriculture related issues:***

The farmers' ranked 1st land levelling followed by the bonded marketing of their produce through Arhti (commission agents) because the farmers buy inputs from Arhti on loan at the time of sowing. Both these issues are ranked with 5 marks. Seed and diseases are the next marked with 4 each. The bonded marketing doesn't allow the farmers to go toward RPL or other choice. The main reason for bonded marketing/ taking credit from private sector (Arhti) is the government banks long and difficult procedures to get loan at the specific time. Therefore, farmers prefer to get loan from Arthis instead of banks. When the production is good (more quantity produced) and government also buy less from the farmers, than Arhti exploit this situation further and offer low price to the farmers even from the government announced price. The Arhti exploit the situation in the following ways,

- Arhti become supplier of the inputs instead of extending loan in cash
- Offer low price of the produce at the time of sale compared to open market or government fixed price for the season
- Delay in payment and trying to compel the farmers to buy commodities from the Arhti
- Quality of inputs supplied by the Arhti is also in question (farmers don't have a choice to check the quality).

The issue of bonded marketing and taking loan from the arhti is almost same except for big farmers who have access to banks. It was also mentioned that till two years back, ENGRO was also active in

rice purchase thus the prices were good and farmer were getting payments timely. But now the ENGRO has stopped the purchase of the rice due to un-known reason and RPL is the only buyer that pays timely but its capacity is less and standards are very hard to meet. Further the capacity of ENGRO is also limited and cannot accommodate all farmers to become their members.

- One of the interesting point that was mentioned by the farmers in village Joyianwala that due to levelling the field, we get 320 - 400 kg more yield per acre of rice but they also mentioned that in rice field, we have to carry levelling every 2nd year.
- The real magic is in high quality of rice Super Hit Variety which fetches better prices and the difference being currently is Rs. 400 per 40 Kg in comparison to 386 Variety.
- Frequently reported is that land is undulating and non RPL farms are often experiencing variation in produce in the same farm due to unlevelled nature of farmland.
- Also farm manure is kept for drying in the open and often for fuel alternate at home stead, however composting proper farm yard manure didn't seem to be a farmer's practice.

Water losses during flow in water course and minor from head to tail:

It was mentioned by the farmers and also observed that minor and water course are un-lined and on average up to 70% losses occur reaching to fields at downstream. The length of the water courses is more and ranging from 1.5 to 3.0 km which further increases water loss. The losses at mid of the WC are less compared to the tail and some farmers mentioned that the losses at mid-level are about 30-35 % while at the tail it is up 80 %. There is a lot of variation in this finding and needs to check in real situation when water flow in water courses during the season. The size of the moga (outlet) is ranging from 5-7 inch depending upon the land allotted to the specific moga (outlet). The farmers were not knowing about the discharge in cusec from moga (outlet) which will be confirmed from the secondary data of the irrigation/ OFWM departments. It was also observed that the moga (outlet) size is fixed, however some time farmers temper the moga (outlet) to get more water by influencing the irrigation Patwari. In such case they pay to the irrigation Patwari of the circle.

- As mentioned earlier that minor and water courses are un-lined, therefore water losses are more.
- I also doubt the cleaning of the water courses by the farmers.
- Less attention of the department to line the water courses may be due to the fact that the area is highly flood prone which results in washing away the government investment.

Access to irrigation water for rice crop:

The farmers mentioned that they only receive water for irrigation in summer (Kharif) season on which they grow rice. Time for one acre of land is about 22 Minutes/ Acre however this variant to 40 Minutes/ Acre for tail end locations- mentioned by the farmers but verification from the department. The length of water course ranging from 1.5 – 3.0 km thus reaching the field in the tail of the water course. They apply water 20-25 times in the whole season and turn is fixed after each eight days. However, the farmers don't wait for their turn of water from canal and run their tube wells to irrigate the crop. The first time irrigation takes more time e.g. 3-4 hours/ acre and then less time (1-1.5 hour) is required to irrigate 1 acre of land as they only apply water to maintain the level of standing water up to 4-6 inches. The farmers also mentioned that the soil is heavy (clayey), therefore after first irrigation once the field is filled (pond), it needs less water. An average, it takes 2 hours to irrigate one acre of field. The farmers of the area mentioned that the time and turn allocation was made during President Ayyub's times and after that no revision is made to the rules. Rice is grown in Kharif, thus on average rain adds up to 25-30 % water in a normal season.

Overall, about the contribution of canal water for crop growth, we got different answers. At up-stream farmers mentioned that 50% water comes from canal, at mid-stream farmers mentioned that only 20

% water comes from canal while at downstream farmers said we only get 10% water from canal. However, this information will be checked with secondary data of the irrigation/ OFWM departments as we feel that farmers were exaggerating especially about water availability from canal.

- Overall we observed that water for irrigation from different sources (canal, tube wells & rainfall) fullfill the water demand of the area, however it may be verified during the season.

Common crops of the area:

Generally, the farmers are growing wheat & rice and only few farmers are growing water melon and tomato for market purpose. Fodder is grown in both season for their livestock as the farmers are keeping livestock for selling milk as an alternate source of income. In case of rice, they grow Supper Hit Basmati variety for export market. Some farmers are also growing other verities like No 386(Indian variety) and few more. It was mentioned by the farmers that supper Hit Basmati delay the wheat sowing by 15-20 days as this is long duration variety which results in less yield of wheat.

S. No.	Crop Name	Season	Duration (Months)	Sowing (Months)	Harvesting (Months)	Marketing (Months)
1	Wheat	Rabi	6 months	15 Nov onward	Till mid may	June-August
2	Rice	Kharif	5 months	15 June onward	Before 15 NOV	Dec-January
3	Fodder for self-use	Both season	3-4 months	Rabi & Kharif		Not for sale
4	Water Mellon & Tomato for market but very few farmer grow	Kharif	3-4 months	Feb	June	May onward

Climate Variation:

Regarding climate change/ variation, farmers mentioned that now we feel very less cold in winter. The winter season has shortened by almost one month while summer season has expanded but overall no extreme event either of cold or hot is observed. In case of rain, extreme events are observed and last year, there was heavy flood due unprecedented rains in the month of Feb. Due to this shift in summer being a long season, the sowing of rice is 10-15 days earlier compare to 15 years back. Further more water is applied to rice crop. Overall 25-30% water is added (supplemented) by the rain in the whole season. Farmers mentioned that we get information about weather through mobile messages from RPL and thus we don't apply irrigation water if there is rain prediction.

- There is need to collect the data from Met Department Lahore and one can calculate the exact quantity of water comes from rain in a normal season.
- Farmers need to be linked with Met Department properly for getting information about whether forecast on regular basis.

Migration:

Normally people don't migrate from the villages rather this area is rich with resources like employment opportunities in local companies/ industries, fertile land but still very few people migrate in case of unemployment. Generally, those people migrate who don't have land or their own house in the villages. Some time, when there are heavy floods, people do migrate temporarily to save their selves.

- Migration phenomenon at tail end is very significant as observed in Kathiawala, one section that we interviewed about 100 HH migrated permanently. The key reason for migration has

remained poverty and search of employment, where lack of skills further exacerbates their vulnerability.

Existing water sources: Their Current and Potential for Utilization

The major sources of water are

- Canal water for irrigation
- Tube well for irrigation
- Pressure Pumps & hand pumps at household level for drinking purpose

It was mentioned by the farmers that up to 20% water requirements are fulfilled by canal water, up to 75 % are fulfilled by tube wells while 5 % are fulfilled by pumps and pumps are mainly used for drinking purpose at households' level. To me the ratio between canal water and tube wells for irrigation looks not realistic and will need to verify from other sources. The farmers are not knowing about the discharge in cusec from moga (outlet) but mentioned that 22 minutes are allocated for 1 acre of land at all locations having a 5-7 inch moga (outlet) size. Similarly, they know about the size of the delivery pipe of tube wells but not knowing about cusec. In case of canal water, they get turn after every 7 days as per their land. The shallow water table is not fit either for drinking nor irrigation purpose. Therefore, they bore for more than a depth of 220 feet to get sweet water. The tube wells and canal water are used in combination to fulfil their requirements in the season.

Almost all the tube wells are self-installed by the private owners (farmers) at the movement depending upon their land holding. The small farmers having land less than 10 acres don't invest much in tube wells installation rather they buy water from the tube wells owners. In case of rice they pay Rs. 6000 – 7000/acre for the whole season. Previously, there were government installed tube wells (SCARP) to pump extra water from the soil of the area to control the water logging but now these tube wells are abandoned. Therefore, the farmers have installed their own tube wells. They also mentioned that the size of delivery pipe (discharge) of SCARP tube wells was also bigger than own tube wells.

Water Projection for use:

They mentioned that 20 years back, the water quantity was sufficient but now it only fulfils 20% needs of the farmers but to me this looks exaggerated. Similarly, the draw down in ground water table is happened by 15-20 feet which is also clear from the fact that government has abandoned SCARP tube wells. All tube wells are owned by the farmers and are functional. Similarly, all pressure & hand pumps at HH level are also functional. The total number of tube wells can't be exactly figured but the number of tube wells is very high and almost every household has installed either pressure pump or hand pump for drinking purpose.

The quality of canal water is good for irrigation while the quality of tube wells water is not good if it is shallow. There is no proper mechanism for O&M but every year they clean water course mentioned by the farmers. Usually, beneficiaries come together on announcement from mosque and clean water course in the beginning of the season. The cleaning of the minor is the responsibility of government but it is cleaned once in two or three years which is mainly dependent upon the availability of fund. The water tariff is very low and farmers pay Rs. 180-200 per season for water to irrigate 1 acre of land. In case of good rains, they don't apply water to their crops but there is no surplus water to grow more land or sell it to other farmers especially from canal.

Annex- 4: Concept Note

Concept Paper for Calculating Economic baseline of Rice Farmers in Muridke, Sheikhupura District

Background:

The main purpose of WAPRO project is to improve the water use efficiency of rice farmers by promoting effective water use as well as better agronomic practices and technologies. All the applied interventions should result in an increase of net income of farmers per unit of land. In order to achieve the said result, one has to calculate the economics per unit of (samples) rice farmers within the project stipulated period of time and to show as successful business case/model to rice farmers other than the project areas. This study will be the part of a larger monitoring framework we have prepared for WAPRO which is aimed at systematically choosing 21 farmers in the area and follow their progress throughout the phase.

Objectives:

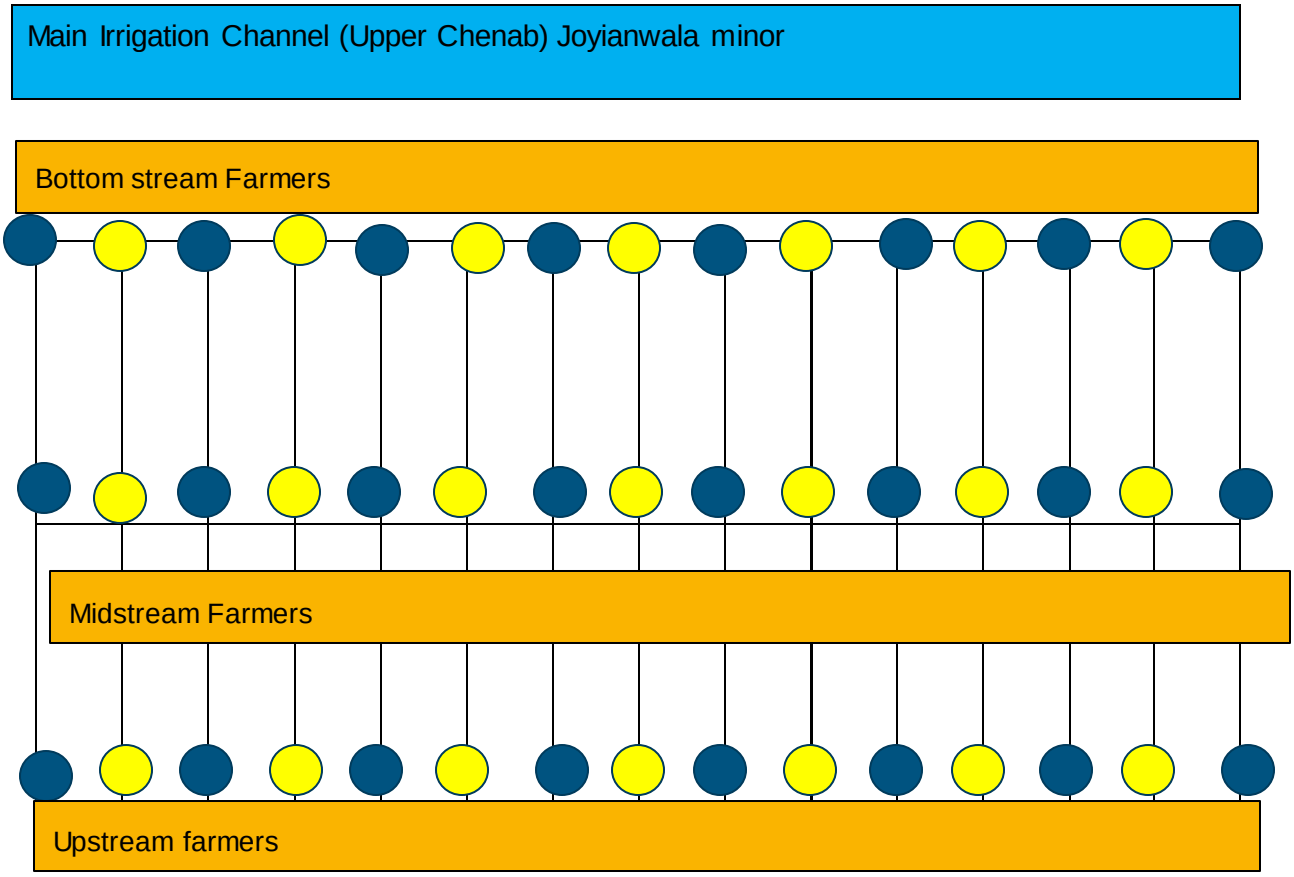
1. To work out the elements of calculating economics of selected rice farmers at a comparable unit by segregating fixed and variable cost.
2. To contribute to preparing the questionnaire for 21 farmers of Joyianwala minor and including data collection needs related to economics.
3. To establish the baseline against the economic indicators once rice seasons (before cultivation and after harvest)
4. To prepare the analysis sheet showing which factors (indicators) are contributing how much in water productivity of rice value chain while calculating net income per unit of land.

Methodology:

The above mentioned tasks will be carried out through a professional (economist) through adopting the following steps;

1. **Selection of water Channel and farmers:**

The geographical location of the project area for the current assignment is already selected: Joyianwala Minor, which is a distributary of the main Chenab canal. There are about 15 water channels coming out from Joyianwala minor, irrigating rice fields of different sizes. The farmers located at Joyianwala Minor (water source) will be selected for measuring the change in their net income as a result of adopting interventions related to water productivity. Out of 15 water channels, 7 channels will be selected (alternate channel) for the study and 3 farmers on every selected water channel will be taken as sample farmers for the said assignment. Thus the total number of the samples farmers would be 21. The following diagram shows the complete picture of the selection methodology at **one water channel**;



2. Data Collection

The economist is expected to design a questionnaire with the economic indicators and train 21 samples farmers[12] for its recording. The questionnaire has to be in Urdu so that farmers could understand it well. The training will be carried out with all 21 farmers within the project area through hands on technique. The data collection will have to be done by RPL and farmers as a continuous process throughout the rice production season. RPL records each input activity and their related cost since the start of the season and likewise record their output along with sale records in the given format as suggested by the professional. At the end, professional is supposed to carry out economic analysis based on collected data to measure the change in their net income. This analysis will further show which elements/intervention of the water productivity package (technology, best agro-economic practices etc.) play the major role for improving water use efficiency in rice value chain.

The professional will go to the field at the beginning to establish the baseline, once in midterm to check if farmers have understood the data collection method and then at the end of the rice season to measures the change against the established indicators.

[12] In case of illiteracy, farmers may take help of their relatives who are educated/literate.