Appendix 1

General Considerations Regarding Intervention and Site Selection in Nepal and India and Illustration of Site Selection Tool

The selection of locales to implement the pilot interventions were driven by analysis of the social and biophysical context as outlined below.

Farmer groups were central to the selection of interventions, so when selecting locales for interventions within the chosen communities teams considered the feasibly of setting up a cooperative, including the collective leasing of land. For example, a pond may be ideal for rehabilitation from a technical perspective, but if most of the land belongs to 5-6 medium farmers, it is not suitable from a socio-economic perspective.

For site selection, three steps were followed as described below:

Step1. Identify areas with a large amount of land belonging to a single landlord. If so, these can be sites for collective leasing. This will apply to much of the land in the Bihar and Nepal sites, where most the land belongs to Zamindars, although this may be more difficult in West Bengal. If the land is made up of many small plots belonging to many farmers, it will be more difficult to do collective leasing – the central institutional intervention of this project. Field maps were used to assist supported by on the ground data from farmers.

Step 2. Once sites are selected, identify the range of technical interventions which can be installed in each site. For example, if a site which has potential for collective leasing already has limited provide opportunity for improved irrigation supply and management in the dry season it can be rejected from the list.

Step 3. Make contact with land owners to see if they are interested in participating in the project, through providing land on lease on a fixed cash rent basis to a farmer group. For some groups, they may need to take leases from more than one land owner if the owned plots are small (this may be an issue in Mahuyahi where there are fewer large land owners). This is potentially the most challenging aspect of the project.

We must be realistic about the size of groups. 5 - 10 farmers would be an ideal size for the farmer groups. If the group becomes too big it could be difficult to manage, and it may be better to split it into two smaller groups. We would expect that in each village we can benefit at least 40-50 farmers.

Site selection considered Institutional, technical and Logistic considerations.

Selection of interventions: Institutional

The collective leasing of land is central to the institutional innovations to be piloted in this project. However, there are several models of collective leasing which can be piloted in different contexts.

1. Mobilise existing tenants on a tract of land to form a farmer group. We expect farmers could still retain responsibility for their existing plots, but the lease can be joint and the rent paid proportional to the land owned, while all the technology (pump sets, solar panels etc) belongs to the group. For pond irrigation, the group could also form a committee to maintain the pond if necessary.

2. Create an entirely new farmer group on leased land. This can be targeted at particularly marginalized individuals (e.g. women headed household, landless hhs). We anticipate this would be smaller scale and would be run as a **pure cooperative**, with the sharing of labour and profits at the end of the season. In one site, we have been provisionally offered some land by a land owner who wants to support a programme for the poor farmers in his village. The land is currently fallow. Again, for these pure cooperatives, all the technology would belong to the group.

3. Create a farmer group of small owner cultivators, who can jointly manage the technology. Therefore, not do collective leasing in these contexts. This may be suitable in West Bengal, although collective leasing can also be piloted, perhaps on a seasonal basis, as per the leasing norms of the region.

It is also worth noting that if there are some plots belonging to marginal farmers (owning less than 0.5ha) in the command area of the system, they could also be included as beneficiaries of the technology without being part of the collective.

The social interventions should also go beyond just collective leasing. Other options which we hope to explore with the farmer groups include:

- Initiation and support of farmer club and self-help group for dry season production and institutional opportunities.
- Support in identifying supply chain for dry season crops.
- Education and training and capacity development.
- Facilitating access to government subsidies for irrigation improvement (eg solar and drip).

Selection of interventions: Technical

There are a number of important points which must be borne in mind when considering the selection of technical interventions.

We need to maximise our impact by channelling our efforts and funds across a number of sites in each village. Budget is however limited. Demonstrating more advanced, and expensive technological interventions (e.g. solar pumps, drip irrigation and storage reconfiguration) at selected sites is important for the project. However, small investment in improved management of existing systems can also **make** a big impact. We must therefore ensure we have a range of “impact” sites in each village, where we can trial lower cost interventions and management change, using existing irrigation farmer systems (e.g.Paddy)and water sources (e.g. tube wells).

We should be in a position to select “impact” sites in each village where we can support target WMT farmers to adopt, or improve dry season agriculture using low cost strategies and existing irrigation methods. Lower cost intervention options include:

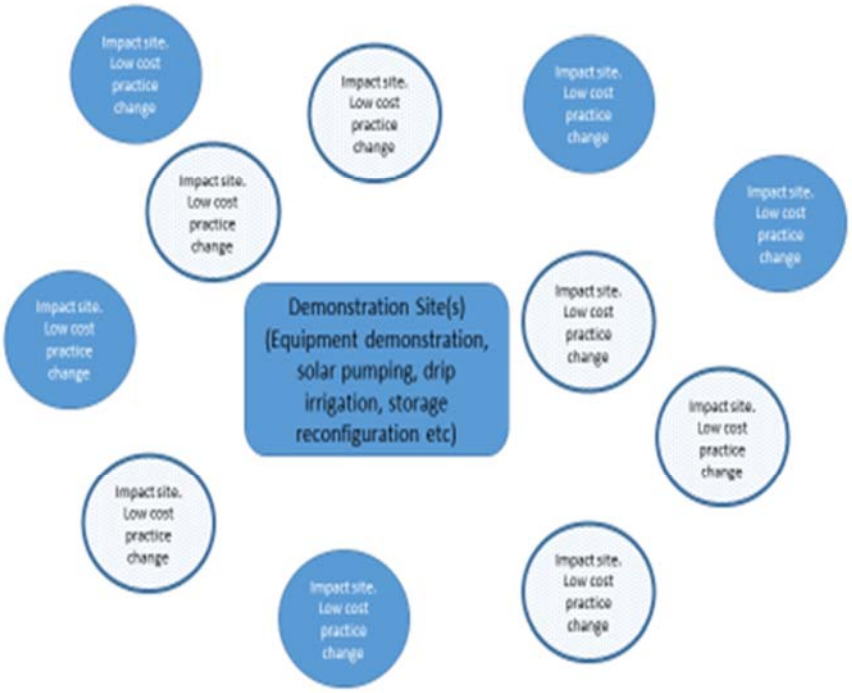
- Trialling improved furrow irrigation layouts.
- Laser levelling and improved field layouts.
- Improved access to existing tubewells
- Filling of ponds from tube wells to maintain water levels in the dry season for fish production and irrigation.
- Minor pond rehabilitation.
- Better irrigation timing and scheduling.
- Soil moisture monitoring and advice.
- Improved pump performance for energy saving.
- Mulching for soil water conservation.
- Better nutrition management for summer crops
- Improved tillage management
- Appropriate crop selection for dry season and training in water management and crop production.

Advanced technologies (eg solar pumping and drip irrigation) demonstrated successfully at a few sites , can then be scaled out following successful demonstration, to the larger number of “impact” sites, over time, possibly using subsidised government schemes or other funding sources. We therefore should identify a range of sites in each village where we can work with the community to identify low cost practice change that is appropriate to their needs, and plan our budget accordingly.

The diagram below illustrates this approach.

- Multiple “impact” sites where we are engaged with communities to change practice, under a low cost scenario, by improving existing irrigation practice using a combination of the social and technological interventions above.
- “Demonstration sites” where we work with communities to evaluate some of the newer more advanced technological solutions.

The shading below represents a phased approach whereby some sites may be established in later years through successful out-scaling. The challenge then as we undertake final selection of “intervention” sites is that we see intervention for what it is – facilitating change. This can be effectively done by making small incremental change to current systems and introducing collective approaches to improve water management based on current infrastructure as well as by demonstration of new technologies.



The pictures below from Bhagwatipur in Madhubani illustrate this concept. There were three active tubewells barely used in the dry season and 50 marginal farmers operating off 20 hectares. A range of social and technical interventions as listed above were considered using both high technology (drip and sprinkler irrigation solar pumping) and low capital cost solutions, using existing tube wells and possibly paddy field redesign (e.g ridge and furrows for dry season vegetables) and better water use efficiency with introduction of water distribution pipes, mulching and improved scheduling. It was envisaged that working as a cooperative significant improvements in dry season production could be targeted with development of local capacity.

Site Selection Tool

A spreadsheet “decision support tool” was used to assist in assessment and ranking of potential sites. Biophysical, Socio-economic and logistical criteria were used. Figure 1 provides an example for Bhagwatipur village (detailed comments have been removed).

Ranking of each selection criteria on a scale of 1-5, indicating suitability of the site in terms of the indicator (5 indicating highest suitability)

Weighting indicated the relative importance of the criteria (5 indicating greatest importance).

This allowed calculation of an overall score for the selection criteria class (biophysical = 52%, socio-economic= 71% , logistics = 57%) and overall score for the village = 61% which could be compared with other villages (see Figure 2).

The tool was not intended to be used as a definitive method to select a village but provided defendable evidence of suitability on a range of dimensions. For Bihar, Bhagwatipur and Mauahi were ultimately chosen. Detailed notes were prepared by project teams for each site, region and country during the selection process and are available in project archives.

Village	Bhagwatipur				District	Madhubani				Block				
Biophysical Criteria	Weighting (1-5)	Ranking (1-5)	score	Comment	Socio-economic Criteria	Weighting (1-5)2	ranking (1-5)2	score2	Comment2	Logistical Criteria	Weighting (1-5)3	ranking (1-5)3	score3	Comment3
Are there sufficient number of ponds representative of larger region	4	3	12		High Population for <0.5 ha owner cultivators or landless tenant/part tenant farmers	5	5	25		Presence of local Champion (govt, farmer group)	4	2	8	
Is there potential for pond irrigation	4	3	12		High Dalit population (low castes)	4	4	16		Are there existing Farmer of SHG	3	4	12	
Are the presence of Tubewells	2	3.5	7		Representative mix of larger region (e.g. sites that contain the predominant castes, socio-economic patterns of larger Eastern Tarai/North Bihar/North Bengal region)	4	4	16		Existing projects by partners, so pre-existing institutional and logistical base can be built upon	3	5	15	
Is the system not reliant on perennial canals	5	5	25		Motivational willingness of farmers to co-invest	4	5	20		Women's leadership in local organisations	3	3	9	
Is the potential for improving dryseason cropping	5	4	20		Is there existing or potential market access	3	4	12		Project partner in close proximity	3	5	15	
Fields and soils suitability for summer cropping	3	4	12		High proportion of women headed households and male migrants	5	4	20		Access to agricultural input supplies	3	3	9	
Mix of energy source scenarios (e.g both electrification infrastructure for tube wells, another diesel dependent, could be spread across the two villages)	2	2	4		Is there a high dependance on agriculture	3	5	15		Landlords willingness to lease land to project	5	5	25	
			0					0		Are thre large pacrels of land belonging to a single landlord	4	5	20	
Suitable groundwater quality for irrigation	3	4	12					0					0	
			104					124					113	
			200					175					200	
			52%					71%					57%	

Figure 1: Site selection tool (Bhagwatipur Village)

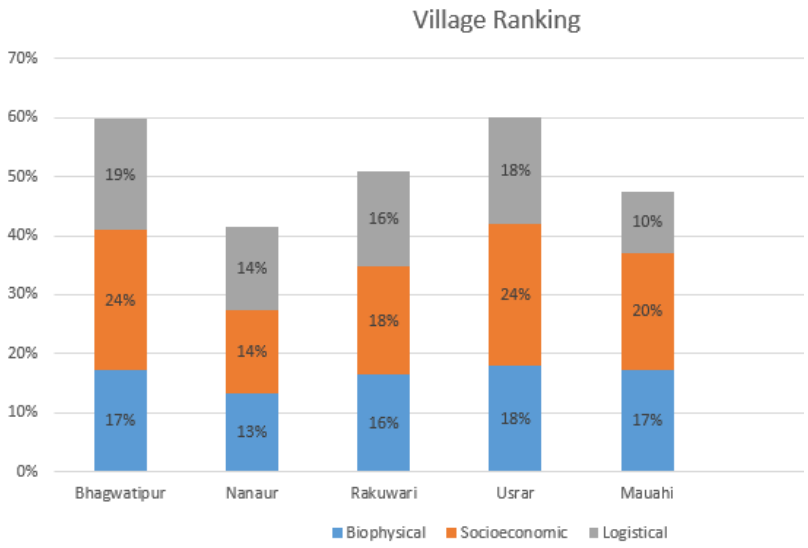
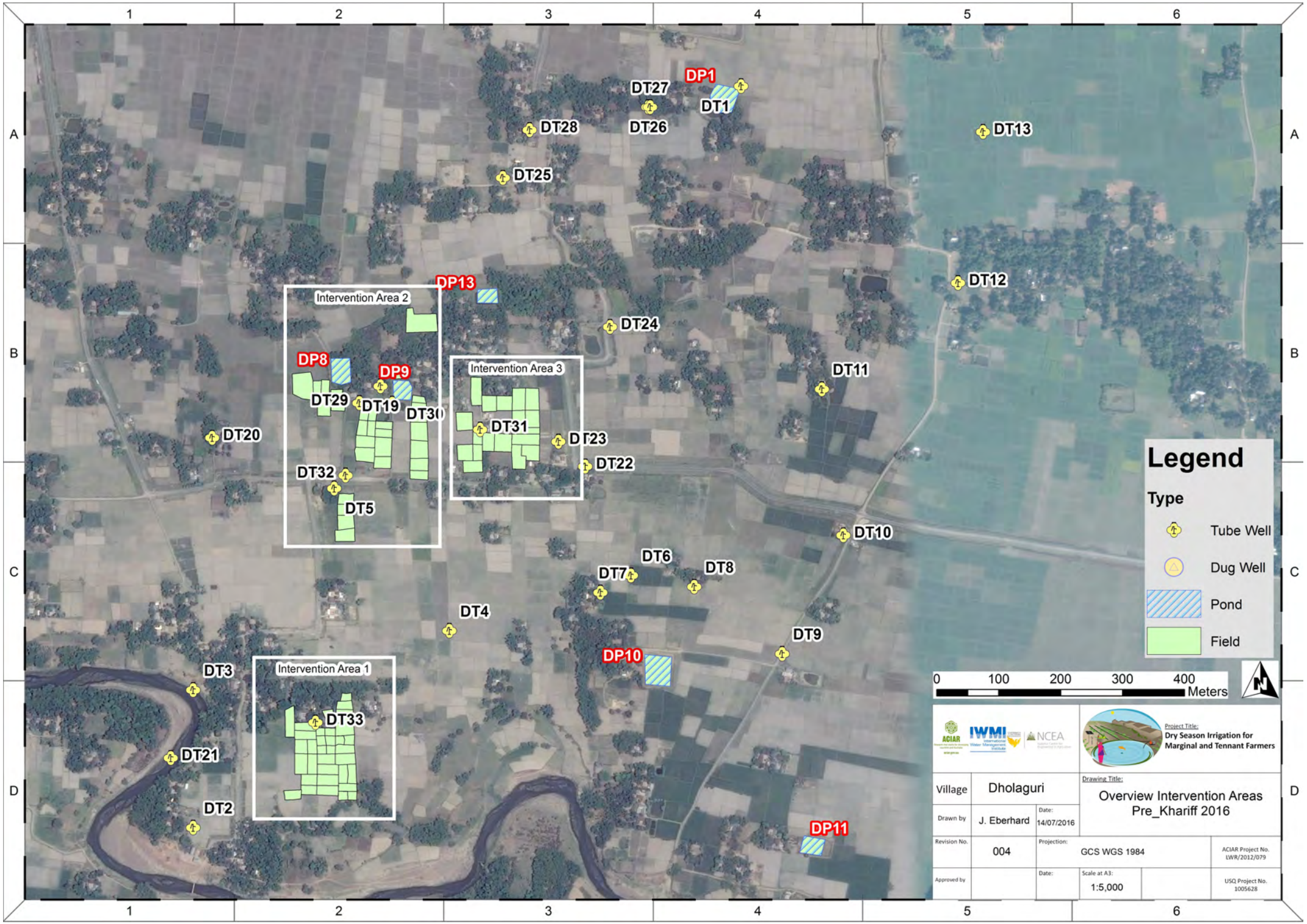


Figure 2: Village Ranking Bihar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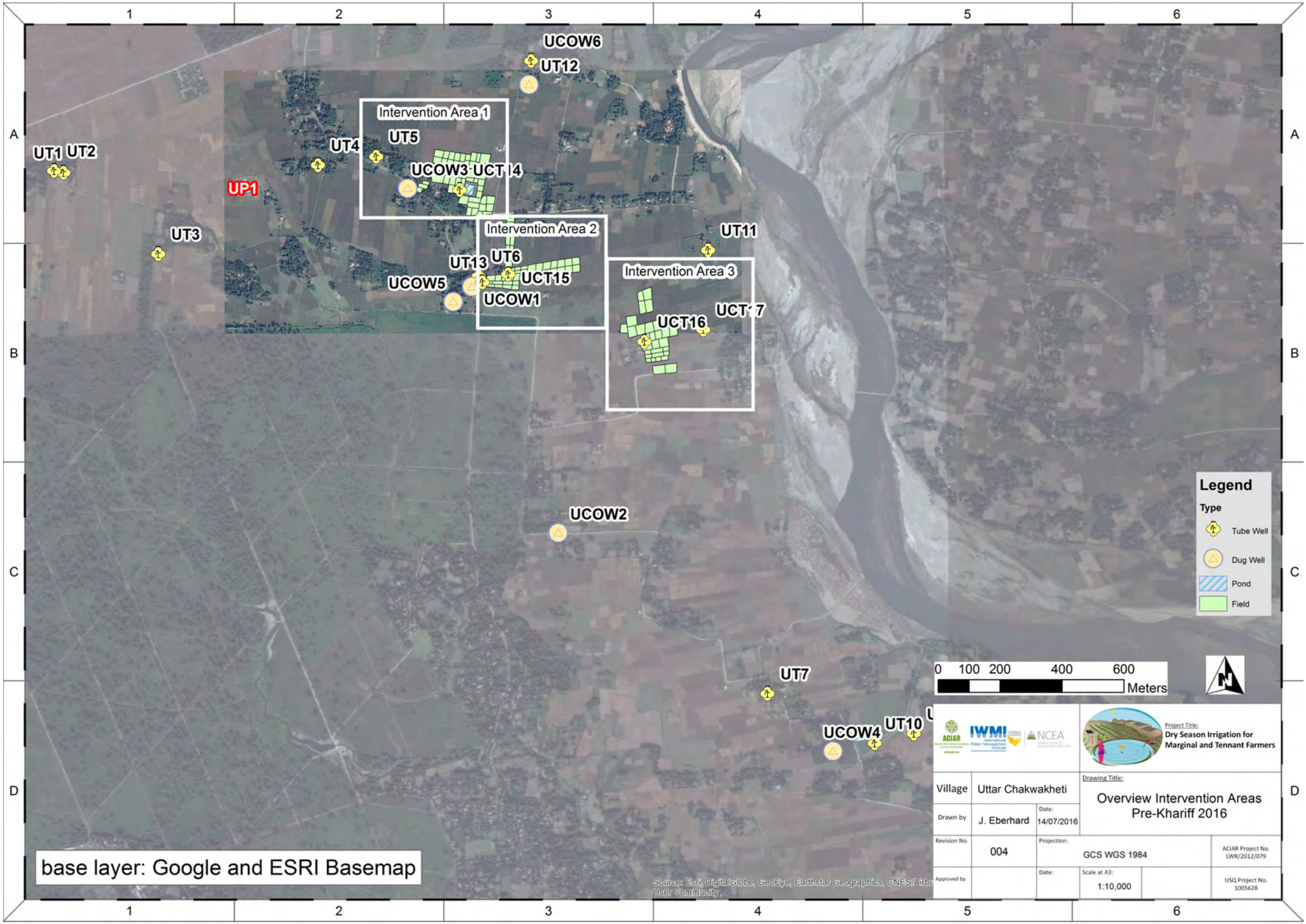
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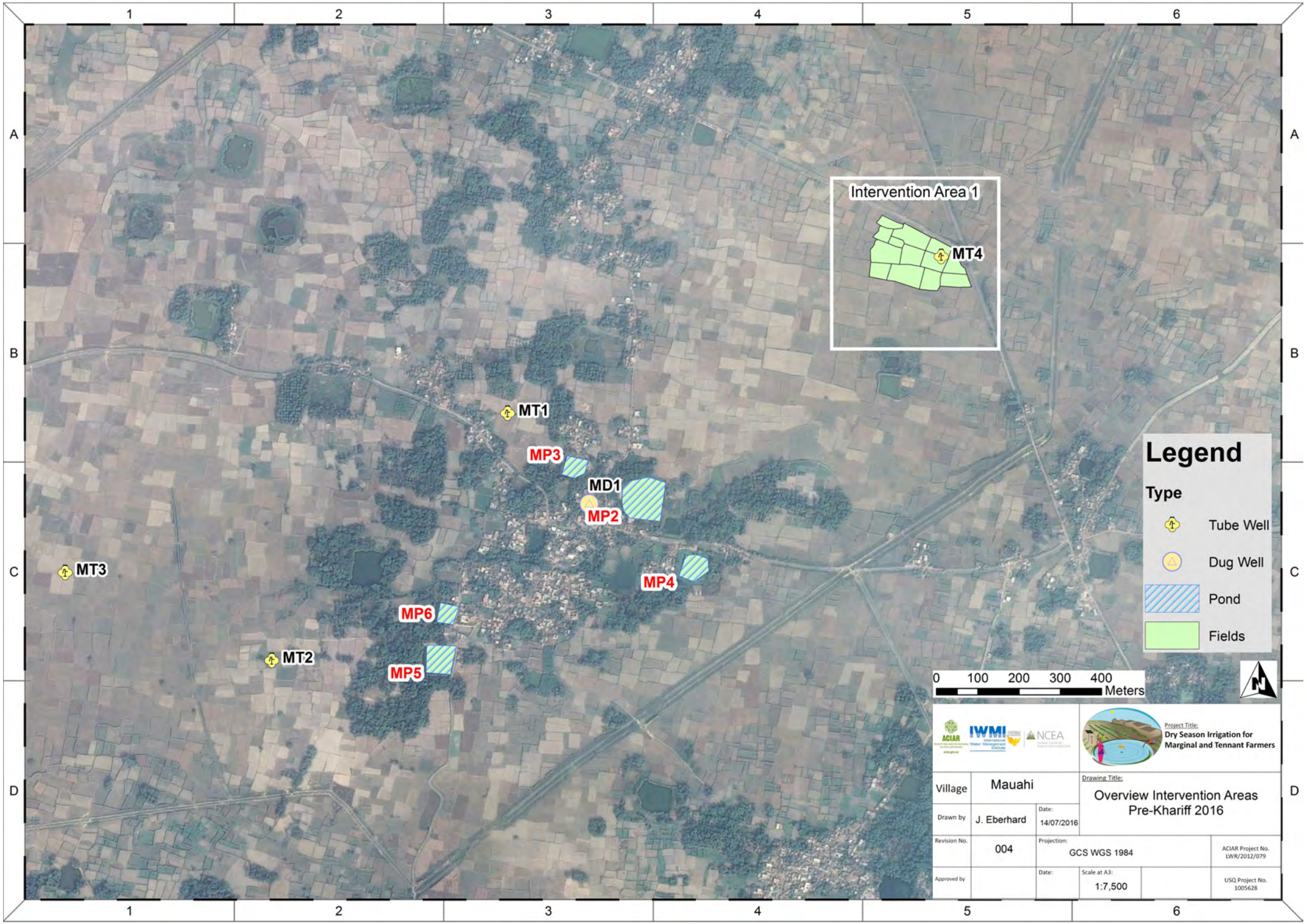
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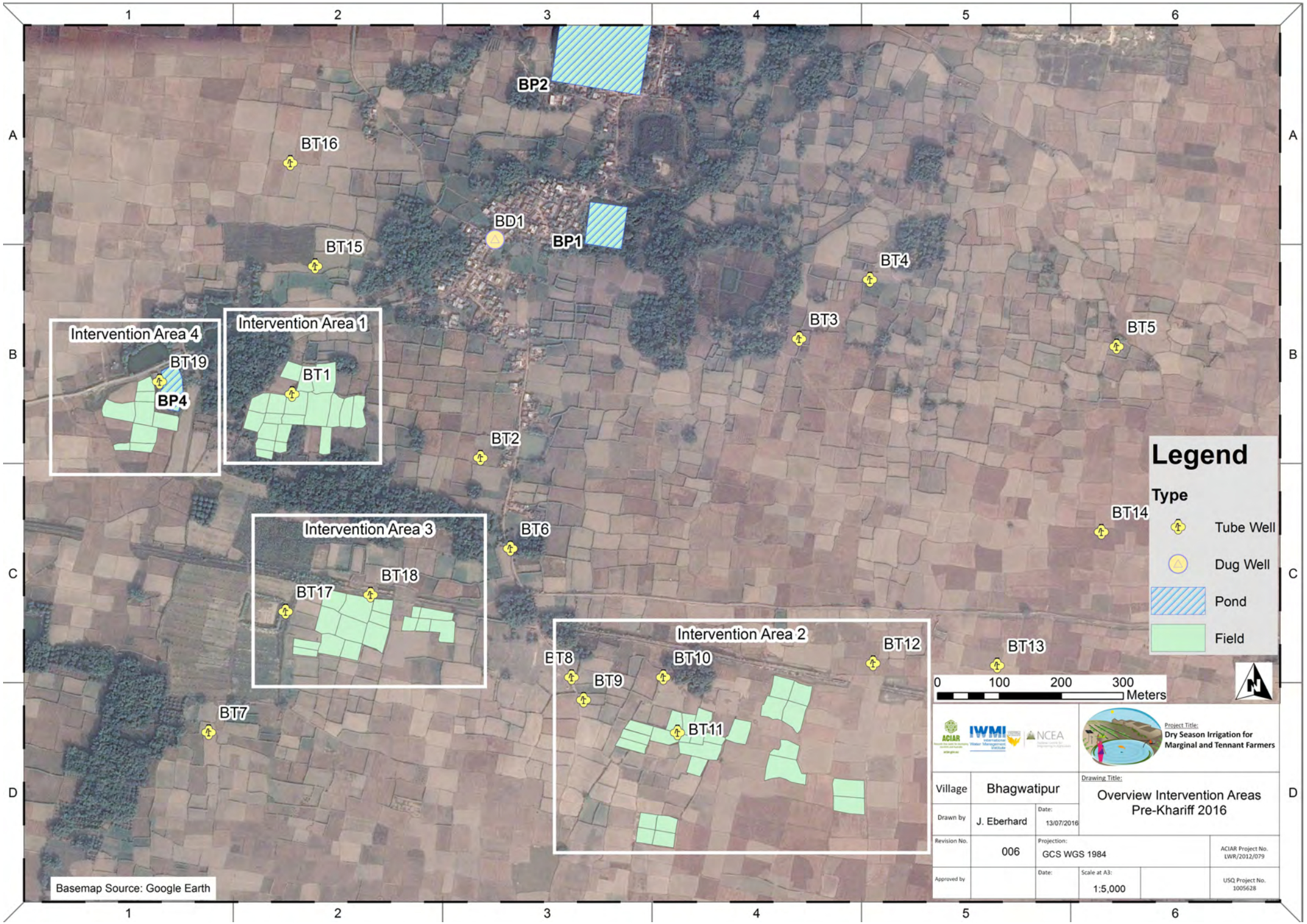
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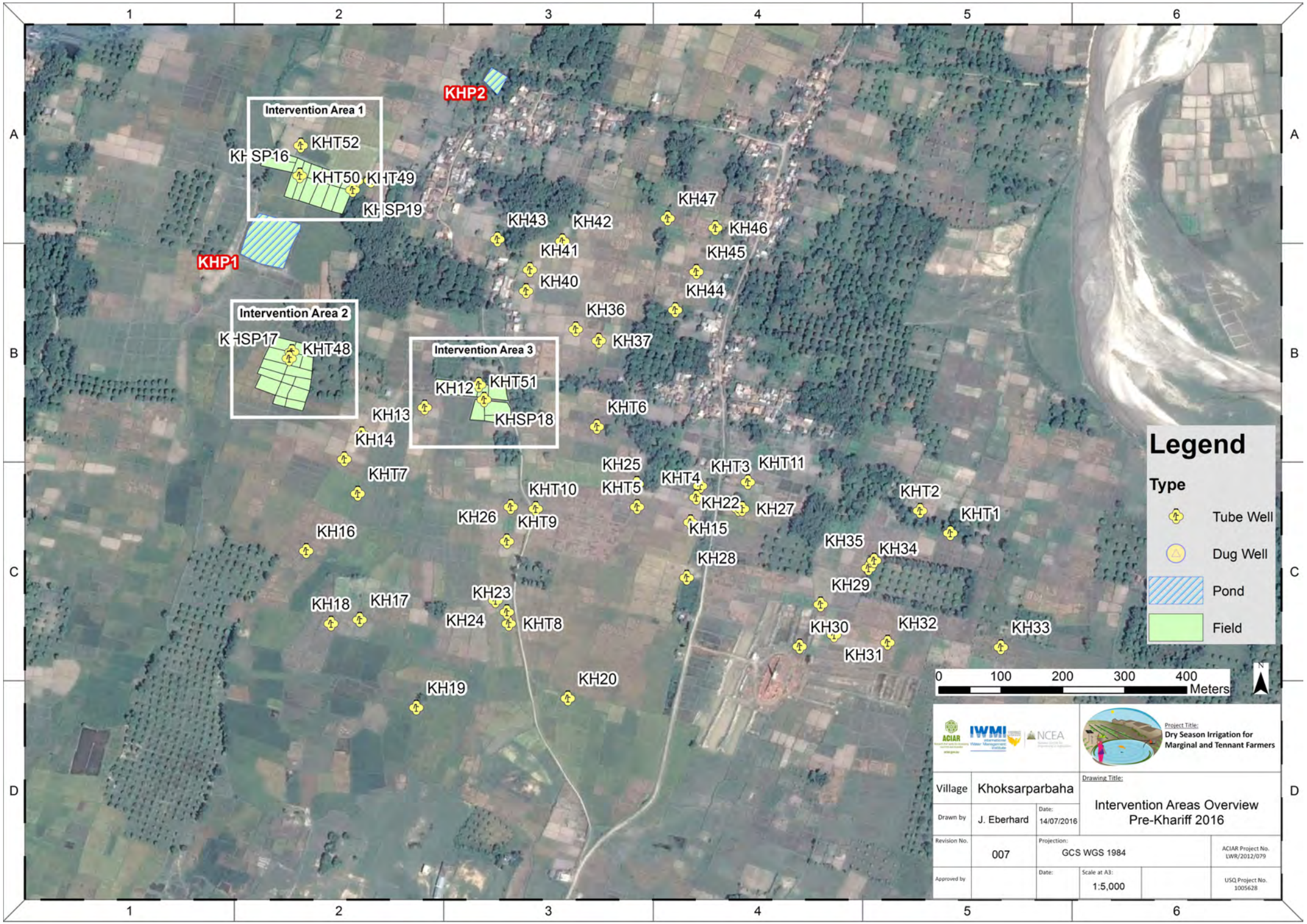
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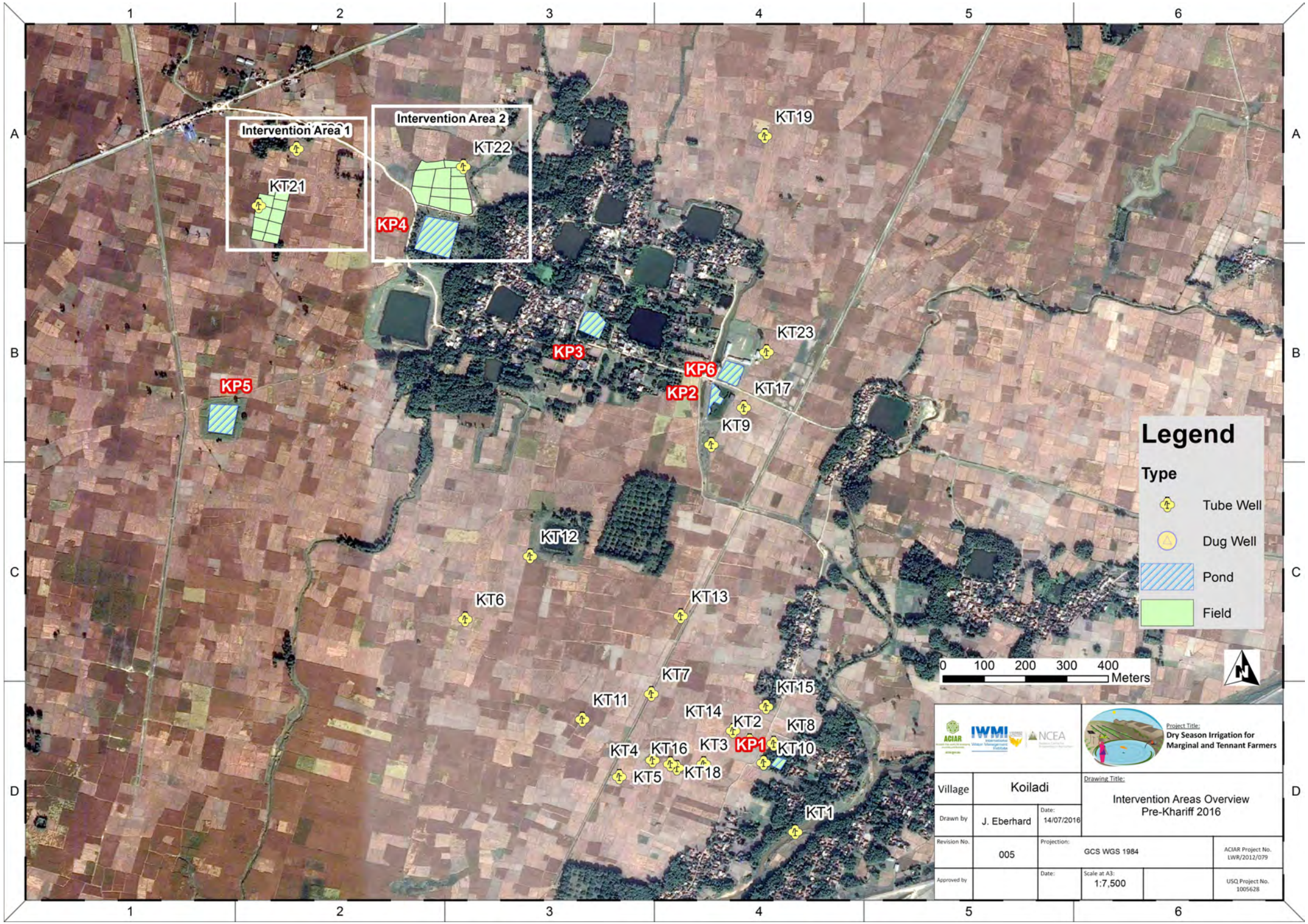
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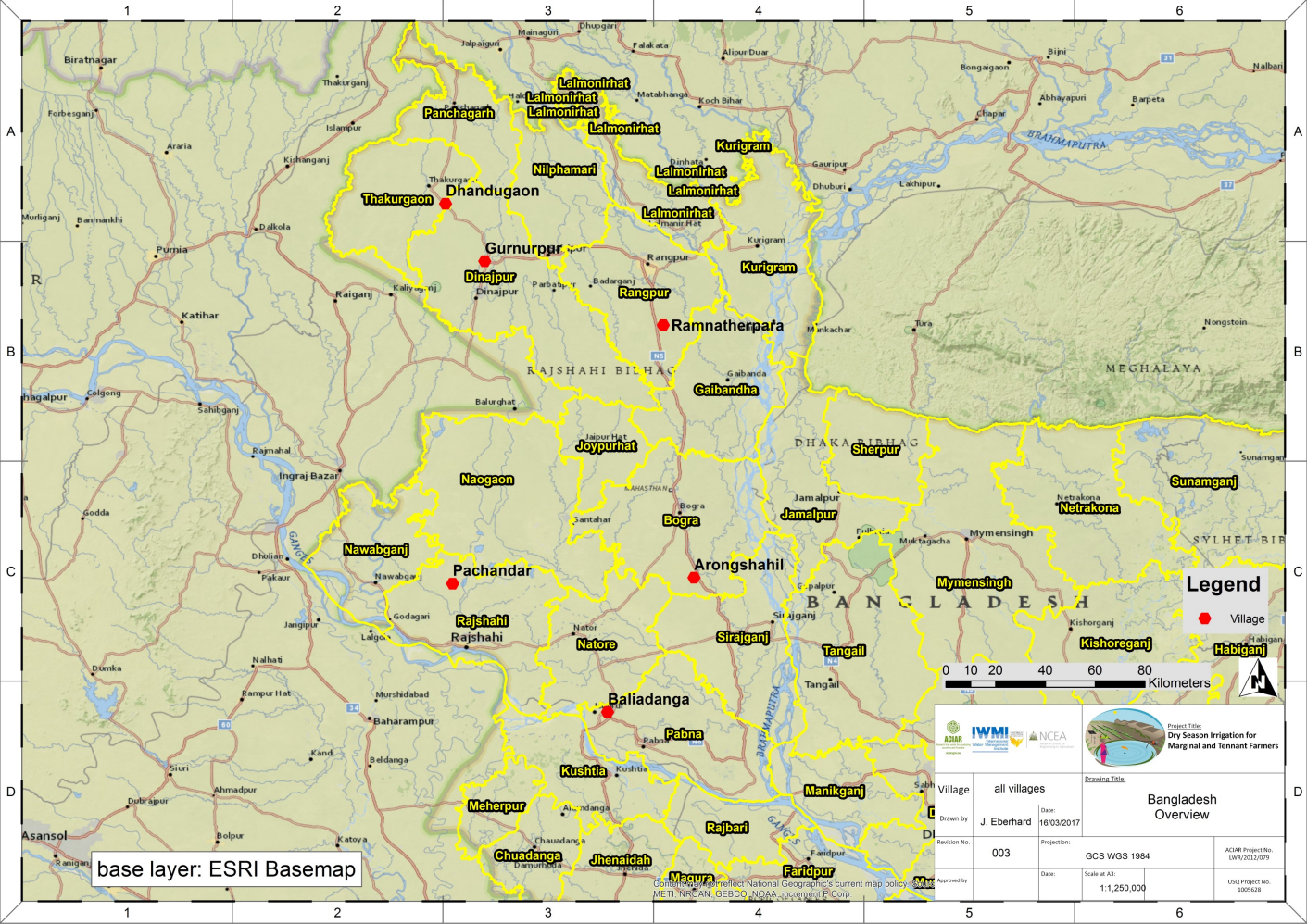
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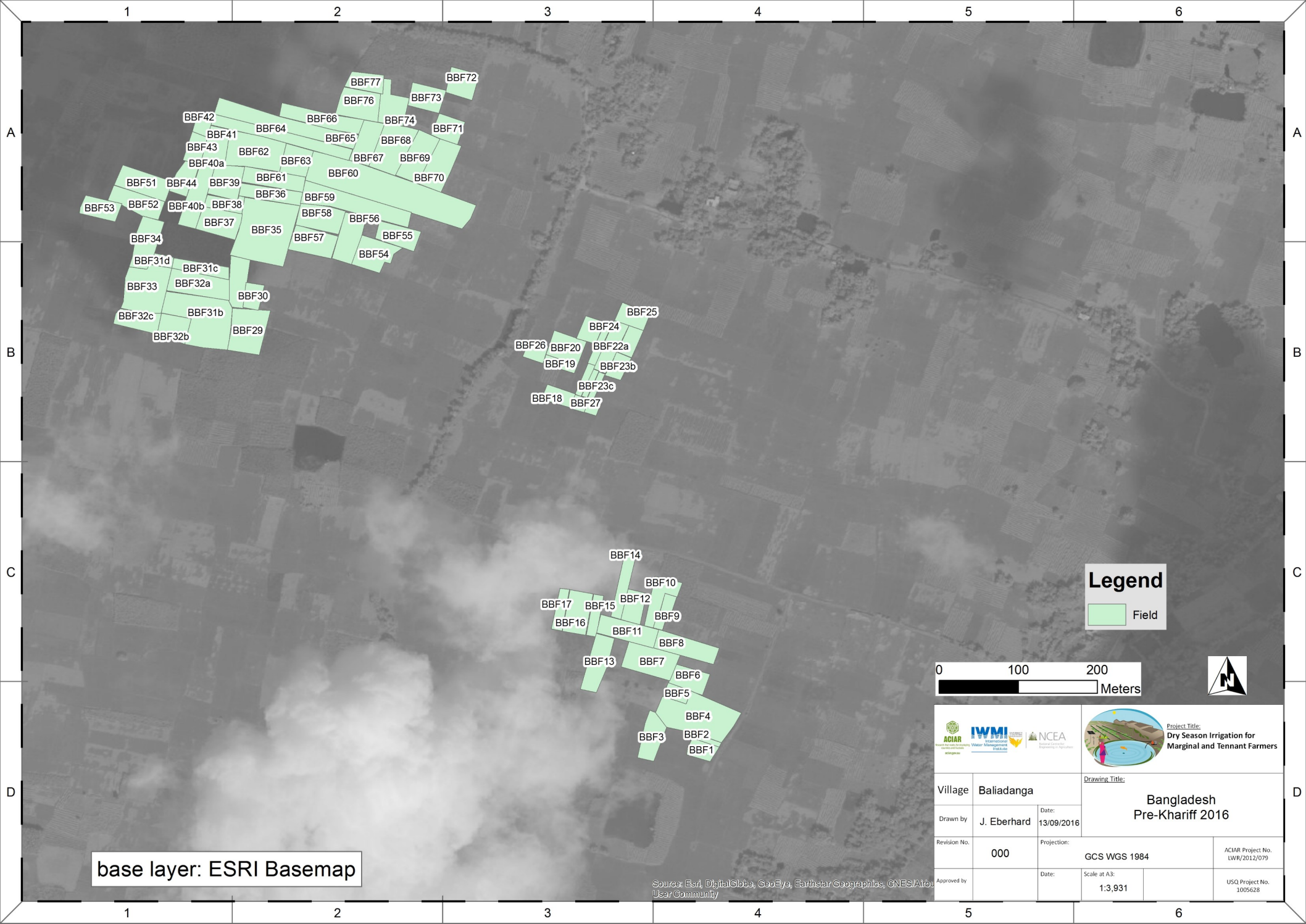
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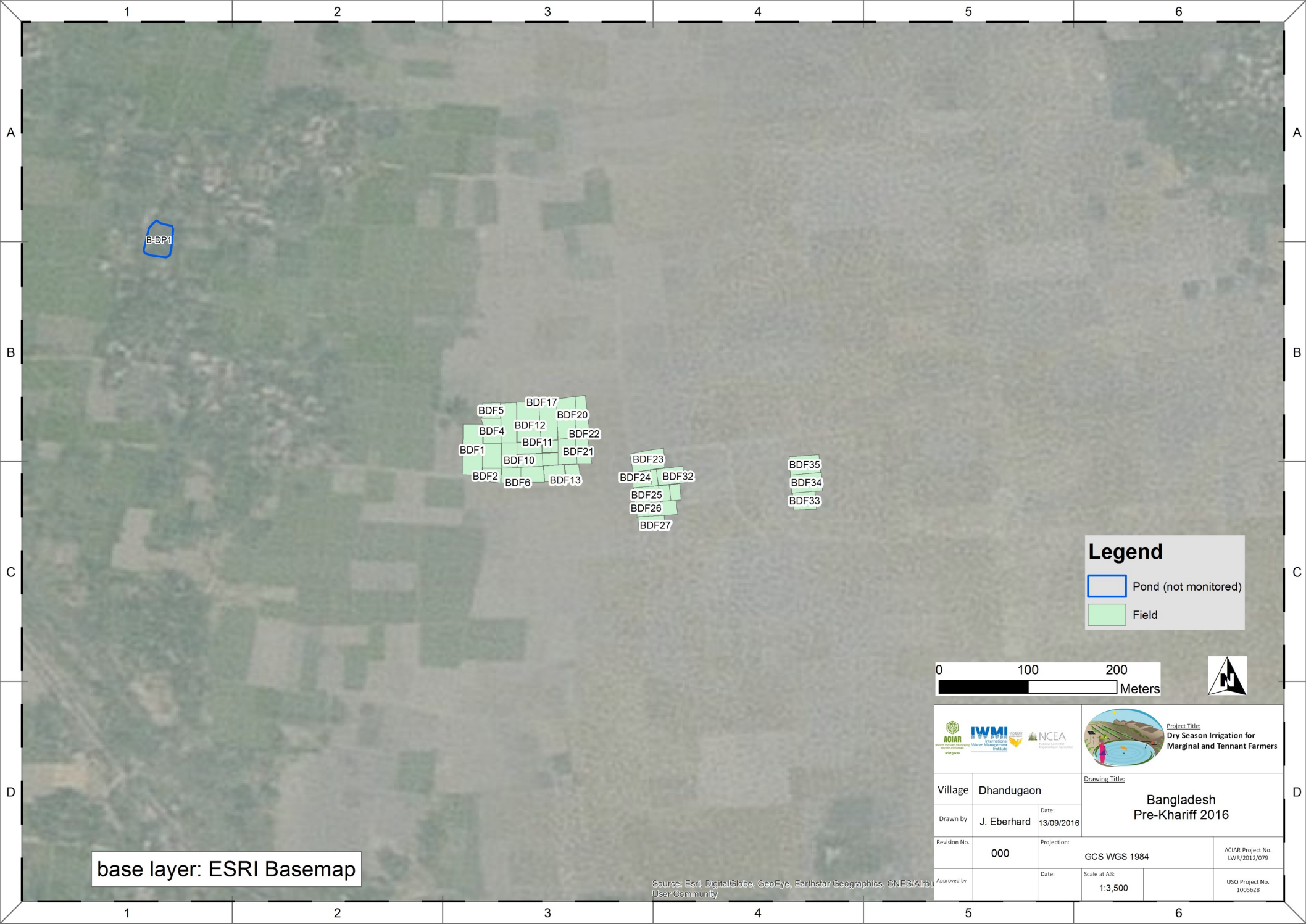
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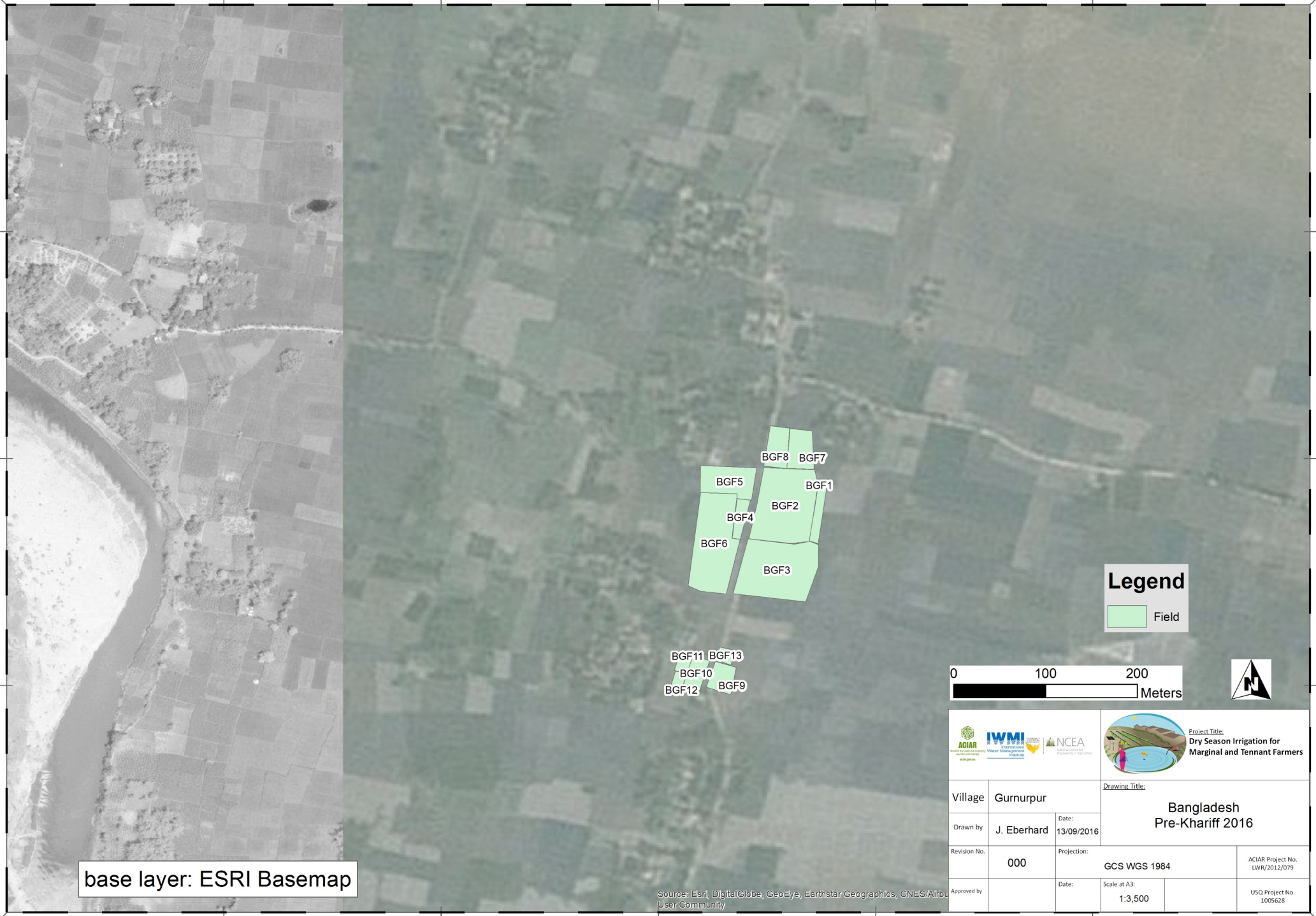

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Approved by		Date:	Scale at A3: 1:1,500 — USQ Project No. 1005628

ACIAR / IWMI / NCEA			Project Title: Dry Season Irrigation for Marginal and Tennant Farmers
Village	Ramnatherpara		Drawing Title: Bangladesh Pre-Khariff 2016
Drawn by	J. Eberhard	Date: 13/09/2016	
Revision No.	000	Projection: GCS WGS 1984	ACIAR Project No. LWR/2012/079
Approved by		Date:	Scale at A3: 1:3,275 — USQ Project No. 1005628

Appendix 3

Engagement, Communication and Capacity Building Strategy and Plan – DSI4MTF

Developed January 2015 and updated/implemented six monthly at local level

Scale	With whom do you need to engage and communicate with?	What do you need to communicate?	How will you engage and communicate?	What actions are needed by you?	When are actions needed?	Who does it
Local	Local farmers – focus on women, marginal and tenant farmers	Opportunities for improved dry land production and water management. Social/institutional change opportunities. Share experiences.	Through village structures and farmer groups and NGO's active in village. Personal invite to participate. Site visits, meetings, questionnaires, focus groups.	Identify target farmers. Establish relationships; Provide support for testing techniques in appropriate circumstances. Undertake activities for engagement and communication in accordance with activity plans.	Ongoing engagement and communication in accordance with activity plans.	NGO's and project team, primarily through regional IWMI project officer and government project appointed staff.
Local	Local farmer groups (woman, marginal and tenant farmers)	Opportunities for improved dry land production and water management through farmer groups. Appropriate social/institutional structures.	Group/ community formation and registration, Community resource mobilization. Participatory resource management, capacity building. Meetings, discussions group forums.	Identify and strengthen existing farmer groups. Capacity building and awareness building. Participatory planning, monitoring and evaluation. Formation and constitution of user groups.	Ongoing engagement and communication in accordance with activity plans. Community forums at least every 6 months.	NGO's and project team, primarily through regional IWMI project officer supported by project lead researchers at appropriate forums.
Local	Landlords	Opportunities for improved dry land production through collaborative farming and alternative farmer/tenant models.	Demonstration of land utilization alternatives, training and capacity building, service provider role, involvement in decision making. Meetings and forums.	Demonstration of approaches on pilot sites. Discuss opportunities with landlords. Seek participation and contribution to project by land access.	Primarily in implementation phase.	NGO's and regional project officers. Local officials.
Local	Local Government and line agencies	Purpose of the program, outcomes and findings. Implications for local communities.	Explain the project, understand their needs as govt officials, make them look good. Invite them to forums and discussions on site. Give them a stake in the project.	Identify local government structures and representatives. Invite to local discussions and demonstrations, regular coordination, build informal rapport. Provide information sheets, newsletters, web resources, social media updates. Provide decision support tools.	Invite to annual regional site meetings and discussions. Ongoing engagement.	National partners (Government and NGO's)
Scale	With whom do you need to engage and communicate with?	What do you need to communicate?	How will you engage and communicate?	What actions are needed by you?	When are actions needed?	Who does it
District	Line agencies (eg equipment suppliers, businesses, distributors, value chain participants)	Purpose of the program, outcomes and findings. Implications for line agency and business opportunities.	Explain the project, give them stake in project. Invite them to forums and discussions on site. Provide opportunities to engage.	Identify relevant line agencies. Invite for discussions, identify opportunities for agency. Support their participation. Provide decision support tools.	Invite to annual regional site meetings and discussions. Ongoing engagement	National partners (Government and NGO's). Project team.
District	Government and district officers	Purpose of the program	Meetings, forums, site visits.	Identify relevant district officers, invite to local activities. Provide decision support tools. Provide information sheets, newsletters, web / smart phone resources.	Invite to annual regional site meetings and discussions. Ongoing engagement.	Government partners, Project leader; local researcher
District	Politicians	Purpose of the program, outcomes and findings. Implications at a district and national level.	Meetings, workshops, briefings, positive press	Policy briefs. Invitations to forums.	At appropriate project milestones where project can demonstrate achievement.	District officers, government partners and project leader.

District	Researchers	Biophysical and social Science outcomes. Opportunities for collaboration.	Pilot/ case study demonstration. Scientific presentations and reports.	Prepare Information sheets, science papers and presentations, attend forums to present. Provide decision support tools. Provide information sheets, newsletters, web / phone resources.	From beginning and when research outputs and plans can be shared.	Researchers
District	Media	Project outputs, outcomes and successes.	Communicate information on field days. Information sheets, briefings, interviews.	Exposure visits, prepare information sheets, arrange briefings for selected media outlets. Provide information sheets, newsletters, web / mobile phone resources.	At project initiation and strategic stages of project delivery and advancement.	Local researcher, project leadership. Project partners.
District	NGO's	Project outputs, outcomes and successes.	Identify key NGO's. Communicate information at field days. Provide information sheets.	Identify relevant NGO's invite to local activities. Provide decision support tools. Provide information sheets, newsletters, web / phone resources.	At appropriate stages of project when success can be demonstrated.	Project partners and NGO's. Project local field officers.
District	Irrigation suppliers	Successes of the project and opportunities for improved irrigated agriculture	Help them understand market opportunity.	Organizing interface meeting with farmers and research team	At appropriate stages of project when success can be demonstrated.	Researchers, Government and NGO partners.
Scale	With whom do you need to engage and communicate with?	What do you need to communicate?	How will you engage and communicate?	What actions are needed by you?	When are actions needed?	Who does it
National	(DG) Head of Research organisations	Purpose of the program, broad outcomes and findings. Implications at a local and national level.	Invitations to key forums and discussions and project meetings. Preparation of briefing notes.	Appointments, make a list of key people, Prepare tailored briefing notes.	Project commencement (awareness) and then at regular occasions when success can be demonstrated.	Project leader and senior person from country
National	National Line departments (Water Res, Ag, Rural, Planning Ccommission)	Purpose of the program, outcomes and findings. Implications at national scale.	Briefings in their offices to explain the project, understand their needs as govt officials, make them look good. Invite them to forums and discussions.	Identify government departments and representatives. Arrange briefings, discussions and demonstrations. Provide information sheets, newsletters, web/phone resources.	Project commencement (awareness) and at regular occasions when success can be demonstrated.	Project leader and senior person from country
National	Policy makers-1	Purpose of the program, outcomes and findings. Implications at national scale.	Through media/ publications, briefings and case studies.	Identify key policy makers. Prepare briefing notes.	Project commencement (awareness) and at regular occasions when success can be demonstrated	Project leader and senior person from country
Scale	With whom do you need to engage and communicate with?	What do you need to communicate?	How will you engage and communicate?	What actions are needed by you?	When are actions needed?	Who does it
International	International donors, NGO's and agencies.	Project successes and opportunities for international irrigated agriculture	Through media/ publications, briefings and case studies	Identify key NGO's of relevance, package information, arrange meetings briefings. Exchange visits. Provide information sheets, newsletters, web / phone resources.	At appropriate stages of project when success can be demonstrated.	Project leaders and in country leaders. NGO partners.

Capacity Building Strategy and Plan – DSI4MTF

Scale	Who requires capacity development through the project?	What competencies need to be developed?	How will you develop capacity of this target group?	What actions are needed by you?	Who does it
Local	Local farmers	• Irrigation and water management • Dry season agriculture • Collective management approaches	Training meetings, discussion forums, demonstrations, information sheets and case studies.	Develop information sheets, establish demonstrations, facilitate meetings and forums, arrange events and document findings.	NGO's , IWMI site representatives, Gov't representatives. Train the trainer by Project Team .
Local	Local farmer groups	• Irrigation and water management • Dry season agriculture • Collective management approaches	Training meetings, discussion forums, demonstrations, information sheets and case studies.	Develop information sheets, establish demonstrations, facilitate meetings and forums, arrange events and document findings.	NGO's , IWMI site representatives, Gov't representatives. Train the trainer by Project Team .
All	Local and National Government advisors, research and extension staff	• Irrigation and water management • Dry season agriculture • Collective management approaches • Research process (survey techniques, data collection and analysis, reporting etc)	Training meetings, discussion forums, demonstrations, information sheets and case studies. Participation and training in research process.	Develop information sheets, establish demonstrations, facilitate meetings and forums, arrange events and document findings. Run research forums and facilitate learning by doing research approach.	National partners (Government and NGO's) and Project Team
District	Line agencies (eg equipment suppliers, businesses, distributors, value chain participants)	• Irrigation and water management • Collective management approaches • Business management skill	Training meetings, demonstrations, information sheets and case studies. Web resources, decision support tools. Business management resources.	Develop information sheets, establish demonstrations, facilitate meetings and forums, arrange events and document findings. Develop web resources and communication and decision support tools. Identify business management resources that can be deployed through web portal.	National partners (Government and NGO's) and Project Team
District	NGO officers and advisors	• Irrigation and water management • Dry season agriculture • Collective management approaches • Research process (survey techniques, data collection and analysis, reporting etc)	Training meetings, discussion forums, demonstrations, information sheets and case studies. Participation and training in research process.	Develop information sheets, establish demonstrations, facilitate meetings and forums, arrange events and document findings. Run research forums and facilitate learning by doing research approach.	National partners (Government and NGO's) and Project Team
District	Project Researchers	• Research process (survey techniques, data collection and analysis, reporting etc) • Monitoring and evaluation • Impact Pathway analysis	Participation and training in research process, PIPA and M&E. Participation in conferences and events.	Run research forums and facilitate learning by doing research approach. Facilitate PIPA and M&E process throughout project.	Project Research team.
District	Project managers, leaders and advisors	• Monitoring and evaluation • Impact pathway analysis • Project management	Participation and training in PIPA and M&E. Participation in Project management training.	Facilitate PIPA and M&E process throughout project. Facilitate learning by doing research management training approach.	Project Research team.

Appendix 4

Participatory Impact Pathway Analysis and Monitoring and Evaluation Plan for the ACIAR project

'Improving water use for dry season agriculture by marginal and tenant farmers in the Eastern Gangetic Plains'

LWR/2012/079

Built by partners and project team members as part of the project inception meeting held at Kathmandu from 17 to 19 September, 2014

Disclaimers

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Participatory Impact Pathway Analysis and M&E Plan for the Improving water use for dry season agriculture by women and marginal tenant farmers in the Eastern Gangetic Plains' LWR/2012/079.

A. Introduction

The Research Program Manager (RPM), Land and Water Resources (LWR) at the Australian Centre for International Agricultural Research (ACIAR) sought to develop a Participatory Impact Pathway Analysis (PIPA) and a monitoring and evaluation (M&E) Plan for project LWR /2012/079 (Attachment 1). A preliminary workshop was held in Kathmandu on July 8, 2014, to scope out a PIPA and M&E plan and planning process. Outlined below is a report on the Participatory Impact Pathway Analysis (PIPA) and Monitoring and Evaluation (M&E) Plan for project LWR /2012/079 built at the inception workshop held in Kathmandu, Nepal, from the 17 to 19 September, 2014. Attachment 2 identifies relevant definitions for terms used in this document.

Overall this Project PIPA and M&E Plan aims to;

- Express the initial project design to better demonstrate consequential steps to achieve research outputs and project outcomes;
- Share ownership of the project planned outputs and outcomes amongst partners;
- Improve project management through supporting continuous learning and sharing of monitoring information;
- Support partner monitoring, data collection and reporting requirements;
- Maximise the benefits of the outputs of the project; and
- Encourage application of accepted ethical principles and standards for evaluation including gender disaggregation of monitoring data.

B. Background

Best practice M&E experience in 'development' identifies the following principles and tools as important:

A. Understanding and mapping the project's 'Theory of change' or 'Impact Pathway Analysis' (IPA) as a participatory activity with partners; and
B. Building an M&E Plan based on;
   a) Identifying the User (who has questions/obligations) for the information derived through M&E data collection processes and the likely use of that information in improvement and reporting actions;
   b) Determining the assumptions inherent in the project causal steps;
   c) Developing evaluation questions – evaluation questions need to be developed for the outcomes and essential causal steps (inputs, activities, outputs, capacity/behaviour changes);
   d) Deciding on an evaluation research design before you decide on monitoring method/s for monitoring key evaluation questions;
   e) Identifying indicators or measures – identifying exactly what needs to be monitored to answer the evaluation questions. What changed, why and where?
   f) Identifying monitoring methods – identifying the quantitative and qualitative methods needed to measure changes expected, with rigour applied to the precise methods chosen; and
   g) Collating data, analysing and reporting results for learning aligned with the IPA format.

C. Method

The Inception Workshop project was convened in Kathmandu, Nepal, by the project leader on September 17, 18 and 19, 2014. The workshop program is provided in Attachment 3. The participant list is included as Attachment 4.

Specifically the workshop activity:

1. Reviewed a preliminary IPA and built a Participatory Impact Pathway Analysis (PIPA) with contributions from all team members from all countries and regions to better understand and document the outcomes expected from the investments and research and extension efforts. The process supported exploration of the intermediate or development outcome steps expected as a result of research outputs being achieved to support achievement of longer term outcomes described in the project proposal. Attachment 5 describes how to undertake a PIPA in further detail and presents an example template.
2. Undertook the development of a preliminary M&E plan based on the PIPA built. The M&E plan consisting of the following sections:

a. *Users of evaluation information:* 'Who wants to know what' and key stakeholders for the project have been identified and listed;
b. *Assumptions:* Assumptions have been derived, listed and prioritised from the PIPA to form the basis for some of the more specific evaluation questions;
c. *Evaluation questions:* More specific evaluation questions have been identified.
d. *Indicators to be monitored:* Exactly what needs to be measured to answer the evaluative questions has been determined;
e. *Methods for monitoring:* The methods for collecting the information to inform the indicators listed have been briefly discussed; and
f. *Overall results chart and reporting template developed:* All monitoring information can now be summarised and placed in a format that reflects the IPA steps and support reporting.

D. Workshop Highlights

42 people attended the PIPA and M&E workshop sessions, 5 of whom were female. Representatives from; ACIAR, University of Southern Queensland (USQ), International Water Management Institute (IWMI), Department of Irrigation Nepal, Sakhi Bihar, CDHI, UBKV, iDE, Bangladesh Rice Research Institute, Nepal Agricultural Research Council, CSIRO, National University of Singapore and country institutions/departments from Nepal, Bangladesh and India attended.

Figure 1. Role playing the different stakeholders and beneficiaries - exploring their part in the project

The end of the first day included a short field visit where a role play for stakeholders in the project was conducted. Groups 'role played' different stakeholders and explored what their stake in the project would be taking a forward and backwards view of the project. An engagement strategy was also constructed by the group in a participatory process for the stakeholders identified.

Figure 2. Stakeholder engagement plan development

Figure 3. Stakeholder engagement plan review

Prior to developing a PIPA, the typical logical steps were identified and workshop participants took part in a role play exploring and listing the different causal steps from 'getting started' to the 'longer term outcomes' for the project.

Figure 4. Attendees at the project workshop building their PIPA and M&E plan

Groups working on their PIPA contributions.

Figure 5. PIPA reviewed, assumptions identified

Figure 6. Questions identified and prioritised

The PIPA built was reviewed by participants, assumptions and questions were identified, listed and prioritised by the working groups.

Figure 7. Information users and uses

Information users and uses for project information were listed by the group.

Figure 8. Indicators, methods, timing and responsibilities for priority questions identified

Priority performance questions were listed and indicators, monitoring methods, responsibilities and timing identified.

Figure 9. The workshop group in front of their PIPA

The group celebrated their efforts in building a PIPA and M&E Plan.

Figure 10. The workshop was then evaluated by the group

E. Eastern Gangetic Plains Impact Pathway Analysis

An IPA is a way of describing the rationale behind the Eastern Gangetic Plains project – what are understood to be the cause and effect relationships between getting started, inputs, activities, outputs, intermediate or development and longer term outcomes. Presented in Table 1 below, the IPA shows a series of expected essential consequences (indicators of success) from investments and this clarifies the project design. Most importantly, the IPA helps to determine what and when to monitor so that monitoring activities assist project management and implementation of the project.

Read me from the bottom up!

Table 1. Improving water use for dry season agriculture by marginal & tenant farmers in the Eastern Gangetic Plains IPA							
Goal	Improved livelihoods for women (WF) & marginal and tenant farmers (MTF) in the Eastern Gangetic Plains through improved dry season irrigated agriculture.						
Longer Term Outcomes 5/10yr	Reduced poverty & increased food security among MTFs with a focus on women farmers.			Improved production through sustainable water and land management (SWM).			
Intermediate Outcomes							
Group/institutional practice change	Groups of WF, MTF and institutions are planning to change water use (WU) practices and policies.	WF & MTF have mobilised and are empowered with increased capacity through group cooperation		Country NGO's, Local Government, Village Development Committees & extension organisations adopt and promote SWM innovations and use to inform policy with a focus on women farmers.			
Key individual practice change	Leading WF & MTF have changed their WU practices and grow dry season irrigated crops profitably.	Successful lead farmers and farmer groups are sharing their WU practices.		MTF and WF have changing tenancy patterns supporting dry season irrigation	Lead WFs are networked to key NGO, agency support people and supply chain organisations.		
Confidence, knowledge & skills change	WF & MTF have confidence in WU & dry season irrigated crop production techniques & negotiate with resource owners.	Country agency water managers, NGOs and extension agents support SWM practices.		Local Government, resource owners and supply chain actors support dry season irrigated crop production and SWM.			
	Partnerships built between project researchers, NGO & local extension staff to support lead WF & MTF & their groups.						
Access to information	WFs, MTFs, local extension, NGO staff, district WU researchers and market chain actors are accessing SWM technical/market information.	WFs, MTFs, NGOs, agency research & extension staff sharing WU project knowledge & experiences.		Innovative technology options for sharing information utilised e.g. mobile telephones, social media etc.	Awareness of dry season WU options increased at local, state and national level, SWM practices demonstrated.		
Initial Outcomes							
Outputs/activities	Lead WF & MTF farmers, resource owners, researchers & extension staff participate actively in demo sites.	Partnerships built between researchers, NGO & agency staff.	Lead WF & MTF trained in WU & dry season irrigated crop practices	SWM techniques & options identified & tested - technically & economically.	Water availability & current use identified.	Water & Land management agencies identified & evaluated for their roles in WU research & extension.	Information on SWM options produced for farmers, NGO & Local extension staff, country agency & project managers.
	Engagement, communications & capacity building strategy & plan produced.	Household vulnerability & socio-economic drivers of communities identified.	Lead WF & MTFs selected & participating.	Demo sites established, NGO & agency extension staff engaged to support sites.	Project management established with M&E & reporting plans.		
Inputs	ACIAR funding & participating country agency 'in kind' contributions made.	Project management & coordination commenced & operational plan & work schedule developed.	Government, NGO & private sector research & extension services partnerships agreed & resources accessed.	Monitoring & reporting templates established.	Participatory operational plan developed identifying schedule of activities by partners.		
Getting Ready	Project proposal, partner agreements, MOUs & timelines agreed. Contracts signed.	IPA, M&E, along with engagement, communications & capacity strategy & plans have been developed & standards for governance, reporting, management (OHS, HR, performance), skills training etc. established with participation of partners.			Partnerships & relationships established & commitments agreed.		

F. M&E Plan

The following steps have been described for the Eastern Gangetic Plains project M&E plan.

a) *Assumptions* (Table 2)*:* Assumptions listed have been derived from the IPA by the workshop group to support risk assessments for the project as well as form the basis for some of the more specific evaluation questions;
b) *Users of evaluation information* (Table 3)*:* 'Who wants to know what' about the project has been identified and listed;
c) *Evaluation questions* (Table 4 and 5)*:* Three levels of questions have been identified;
    i. Overarching questions about achievement of the outcomes planned in the project;
    ii. Key evaluation questions (Table 4) that deal with a selection of higher order issues of governance, effectiveness, appropriateness, efficiency, legacy and impact; and
    iii. Specific evaluation questions (Table 5) such as; where there unexpected outcomes, gender issues and planned project steps.
d) *Indicators to be monitored* (Table 4 and 5)*:* Exactly what information is needed to answer the evaluative questions asked has been determined;
e) *Methods for monitoring* (Table 4 and 5)*:* The methods for monitoring the indicators listed have been chosen; and
f) *Overall results chart and reporting template developed* (Table 6)*:* All monitoring information can now be summarised and placed in a format that reflects the IPA steps that allows for progressive collection of data, interpretation of data and assimilation of quantitative and qualitative data/information into a useful state for summarising achievements.

a. Assumptions Implicit in the Project Impact Pathway

Table 2. Assumptions implicit in the project impact pathway: Improving water use for dry season agriculture by marginal and tenant farmers in the Eastern Gangetic Plains. For these outcomes to be achieved it is assumed that[1]:	
Longer Term Outcomes 5 to 10 years	• Restructuring of institutions supports project delivery. XXXXXXXXXXX • Agriculture continues to be the mainstay of WF and MTF. XXXXX • There is good cooperation among the three participating countries. XXX • Increased dry season production meets some market demand. XXX • The interests of the project coincide with those of the key stakeholders. XXX • 3 years is enough to deliver change. XX • Impact and outcome achieved is measurable. X • Canal irrigation developments will not interfere with the project.
Intermediate Term Outcomes	
Group or institutional practice change	• WF and MTF are interested in a collective approach. X • Project team operates across regions.
Key individual practice change	• Study sites will be free of natural disasters. XXXXXXXXXXXXXXX • WF and MTF are willing, available and have capacity to participate in the project. XXXXXX • Resource owners and lessees provide access for demo sites. XX • Lead WF and MTF are able, given cultural norms, to share information on techniques. XX • Demonstration sites will engage farmers and influence adoption of techniques. X • Resource owner's value improved WU.
Confidence, knowledge & skills change	• WF and MTF communities are engaged and motivated to participate in demonstration sites. XX • Inter community rivalry does not disrupt demonstration site development and use. X
Access to information	• Appropriate modes of communication are used for stakeholder groups. XXX
Initial Outcomes	
Outputs	• Government interest and policy priority for the eastern region continues. XXXXXXXXXXX • Cohesive, cooperative and well lead groups develop. XXXXXX • There is enough water quantity and quality for irrigation to have a significant impact. XXXXXX • Key farmers and champions are willing to lead groups. XXX • Project team has the required skills. XX • Linkages are made between local and country level organisations. X • Lessons learned are made available for communication to different audiences. X

[1] Number of X's represents a ranking of priority allocated by workshop participants.

Table 2. Assumptions implicit in the project impact pathway: Improving water use for dry season agriculture by marginal and tenant farmers in the Eastern Gangetic Plains. For these outcomes to be achieved it is assumed that[1]:	
Activities	• Project participants are willing to engage. XXXXXXXXXXXXXXXXXXXX • Project partners are appropriate and the right partners have been engaged. XXXX • Project interventions are site specific and successful technically. XXX • Institutions support partners to undertake project activities. XXX • Target groups/farmers are identified appropriately. X • Sufficient technical skills are available. X
Inputs	• Project funds are received on time. XXXXXXXXXXXXXXXXXXXXXXXX • Project inputs occur in a timely fashion. XXXXXXXX • Partners commit resources planned for project. XX • Ethics clearance is achieved.
Getting Ready	• There is credible commitment by partners. XXXXXXXXX • Arrangements made for project management, engagement of staff and partners and resourcing are appropriate. XXXX

b. Users and uses of monitoring and reporting information

Who wants to know what about the project and how we are progressing, how will the users use the information?

Table 3. Users and uses of project information	
Users: Who wants to know what about what we are doing and how we are progressing with the project?	Uses: What information do they want? How will the user use the information? What will they do with the information?
1. Women Farmers and Marginal and Tenant Farmers including lead farmers and farmer groups:	Clear and simple messages. To; • Gain knowledge to improve confidence to try new dry season irrigated crops using water in a different way, produce food and make more income; and • Share knowledge and experience with other farmers and compare performance with other farmers.
2. Country (Government) policy developers.	Briefings and interactive and formal exchanges of information. To; • Improve policy and program development for SWM; • Improve planning for SWM systems in agriculture; and • Increase investment in SWM in agriculture to aid decision making.
3. Government Departments and other agencies (e.g. Research Institutes).	Information dissemination processes to support actions by government and other agencies. To support; • Outscaling and upscaling of technologies; • Replication of information to other regions; • Improvement in research process; and • Project management in implementation.
4. Funders, donors and partners: a. ACIAR; b. Department Foreign Affairs and Trade (Australia); and c. Heads of collaborating research organisations, media, NGOs and government agencies.	Information in different forms. To support; • Learning and future planning; • Ministerial and diplomatic briefings; • Production of project reports, Departmental reports; • Continuing alignment of project investments from donors, funders and departments; • Building the profile of Australian and partner contributions and demonstrate achievement of Australian aid goals; and • Monitoring governance and performance on the pathway to impacts.
5. Project team: a. Project Management Team; and b. Project working groups.	Data and monitoring information. To; • Monitor contracts; • Communicate key findings; • Engage participants; • Building capacity of participants; • Inform partners M&E systems; • Contribute to continuous improvement in project delivery through use of monitoring information by managing groups; • Support the project's M&E plan to build annual and half yearly reports and reviews; • Inform post project impact assessments and project final reviews; • Inform future investment; and • Publish findings.

c. Evaluation questions

The evaluation questions take three forms:

1. The overarching questions that relate to whether the project has achieved it's longer term outcomes (post project);
2. Key evaluation questions to assess the project in terms of governance, appropriateness (relevance), effectiveness, impact, efficiency (benefit/cost) and/or legacy (Attachment 2 for definitions of terms); and
3. Specific evaluation questions about components of the project as listed in the September 2014 workshop PIPA and M&E Plan produced.

Information to answer these questions is derived from monitoring the indicators chosen in the M&E plan for the project.

1. Overarching evaluation questions (post project)

The overarching evaluation questions for the project relate to the longer term outcomes identified for the project are;

i. Has there been an improvement (or is one expected) in livelihoods of targeted women and marginal tenant farmers in the Eastern Gangetic Plains from dry season irrigated cropping applying improved SWM practices? Why or why not?
ii. To what extent has poverty been reduced and/or food security increased among women and marginal tenanted farmers from dry season irrigated cropping applying improved SWM practices? Why or why not?
iii. Has there been an increase in dry season irrigated cropping productivity, production and/or profitability among women and marginal tenant farmers through improved SWM practices being applied? Why or why not?
iv. Did relevant country government agencies, NGO's, Local Government and extension organisations adopt SWM policies and extension programs, if so why and if not, why not?

The evidence to be assessed to answer the overarching questions will come from monitoring information tabulated in the results chart (Table 6) built for the project from regular reporting processes, including for governance, inputs, activities and outputs in addition to the monitoring information gathered from answering the specific evaluation questions listed below in section 3. The evidence aggregated from the various reports and quantitative and qualitative surveys will be best assessed by a panel comprised of the project steering team, key selected partner, NGO, extension and farmer representatives as part of the annual review (Year 3) and final project review processes.

2. Key evaluation questions (KEQ Table 4)

The key evaluation questions are high order questions about the project overall. The project M&E plan provides a range of indicators to monitor to produce information to answer the key evaluation questions chosen for the project. Key evaluation questions are explicit questions to be answered for the purposes of reporting and/or improvement as illustrated in Table 4 below. Key evaluation questions are answered from the same assessment process as explained in section 1 above. A relevant selection (subset) of KEQs needs to be made for the project by the management team.

3. Specific Evaluative Questions for the Project (Table 5)

Specific evaluation questions are listed in Table 5. Specific evaluation questions include whether there were; unexpected outcomes; gender differences in participation and adoption; and if the planned project steps were achieved and if not, why not?

Table 4: Key evaluation questions, User, evaluation design and methods.					
Evaluation purpose	KEQ.	User	M&E design comment. Attachment 6.	Indicator	Methods
Impact. Achievement of longer term outcomes planned.	What changes have occurred, either directly or indirectly produced by the project interventions? What, if any, unanticipated (adverse) changes or other outcomes have resulted?	WFs, MTFs. NGOs and extensions staff. ACIAR. IWMI/USQ. Project management team. Institutions and government agency research teams.	Currently ACIAR conducts ex post 'impact assessment' evaluations for projects using external resources in a mixed evaluation design. The evaluation design for this project for impact evaluation could be based on an implicit design where a purposeful sample (15 to 20) of stakeholders per region e.g. key informed WFs and MTFs, NGO personal and research/ extension agents, are interviewed annually.	Targeted WFs and MTFs adopt tools for SWM and undertake dry season cropping. Intermediate outcomes e.g. access to information, sharing of knowledge by participants and beneficiaries, confidence change in targeted farmers and local NGO & extension officers. Policy changes towards SWM by NGOs, country research and extension agencies.	Purposeful[2] sample using open ended questions with participant involvement in analysis of responses. The 'purposeful sample' would be interviewed using an Appreciative Inquiry[3] technique annually. Gender needs observed through provision of separate spaces/interviews for men and women.
Effectiveness Achievement of project activities and outputs planned, using the inputs and techniques planned.	To what extent has the type, level and context of the inputs and activities made progress towards the desired project activities, outputs and outcomes, Why or why not?	NGOs and extensions staff. ACIAR. IWMI/USQ. Project management team. Institutions and government agency research teams.	Project partners, stakeholders and beneficiaries report to project management as activities and outputs roll out. This includes half year and annual review processes where information is tabled on the techniques applied to achieve the activities and outputs. Information tabulated to include attendance, participation and training and engagement evaluations with gender disaggregated information.	Agreements made, resources committed and delivered. Inputs, activities and research outputs achieved. Engagement, communications and capacity building plans delivered and evaluated. Extension and training activities with gender and youth information disaggregated. WFs and MTFs communication, engagement and capacity (gender disaggregated).	Project management team is required to report on project arrangements, target farmers selection, inputs, activities and outputs achieved. Activities undertaken are assessed as part of the implementation e.g. extension officer and lead farmer training is assessed as delivered (Training evaluation with gender disaggregation for both attendance and evaluation). Research outputs and activities are self and peer reviewed and assessed during delivery as per the ACIAR activity and output reporting templates and annual and half yearly reviews. Information is to be noted in the format of the IPA headings as found in Table 6.

[2] Purposeful sampling is about selecting cases for study because they are information rich and illuminative. They offer useful insight about the phenomenon not empirical generalisation from a sample to a population.

[3] Attachment 7 explains the Appreciative Inquiry method.

Table 4: Key evaluation questions, User, evaluation design and methods.

Evaluation purpose	KEQ.	User	M&E design comment. Attachment 6.	Indicator	Methods
Appropriateness (Relevance).	Did the program meet the relevant needs of the intended beneficiaries? To what extent are the activities and outputs proving useful in engaging and influencing the targeted stakeholders?	WFs, MTFs. NGOs and extensions staff. ACIAR. IWMI/USQ. Project management team. Institutions and government agency research teams.	An implicit approach can be taken where participant and targeted WFs and MTFs can be continuously monitored. Purposeful sample (15) of stakeholders e.g. WFs, MTFs, NGO & extension agents, are interviewed annually per region.	Research outputs find feasible SWM options for dry season crops. Participation (gender disaggregated) in research, training and extension activities, outputs and intermediate outcomes. WFs, MTFs, extension & NGO officers access/use of new water management tools. WFs and MTFs uptake of new water management techniques.	Purposeful sampling for Appreciative Inquiry monitoring method undertaken with target WFs and MTFs, NGO's, and partners in the field over the last two years of project implementation. Both group and individual samples made with gender needs observed through provision of separate spaces/interviews for men and women using appropriate surveyors. Participant involvement in analysis of both quantitative and qualitative information.
Legacy (Sustainability).	Will there continue to be impacts over time and after the project ceases - Why or why not?	WFs, MTFs. NGOs and extensions staff. ACIAR. IWMI/USQ. Project management team. Institutions and government agency research teams.	An implicit approach can be taken where participant and targeted WFs and MTFs can be continuously monitored and this sample can be part of any post project monitoring. Purposeful sample (15) of stakeholders e.g. WFs, MTFs, NGO & extension agents, are interviewed annually per region.	WFs and MTFs group formation. WFs and MTFs participation in demo sites as a group and as individuals and their use of techniques devised. NGO and extension agencies adoption of SWM techniques and development of programs to support such for other groups.	Purposeful sampling for Appreciative Inquiry method undertaken with target WF and MTFs, NGO's, and/or research partners in the field 5 years after project implementation. Both group and individual interviews made with gender needs observed. Participant involvement in analysis of responses.

Table 4: Key evaluation questions, User, evaluation design and methods.					
Evaluation purpose	KEQ.	User	M&E design comment. Attachment 6.	Indicator	Methods
Efficiency.	Did project management obtain the highest value out of project resources?	ACIAR. IWMI/USQ. Project management team.	Project action management will be supported by the project M&E plan monitoring activities. ACIAR's ex post impact analysis should be based on the IPA and M&E plan developed for the project and be participatory.	WFs and MTFs participation and adoption of SWM and dry season irrigated cropping practices developed. NGO and extension agency capacity development and ongoing support for SWM practices developed.	Use of purposeful sample of WFs and MTFs, NGO and extension people and continued interview process with additional economic analysis.
Governance.	Did project management actions comply with the set of responsibilities and practices, policies and procedures, set by ACIAR's executive, the Australian Government and the partner country governments?	ACIAR. Project management team. Institutions and government agency research teams.	Internal audit of partner acquittal and contract processes.	Partner agency acquittals and reporting of ACIAR project funding allocated. ACIAR funds acquittal and reporting of such for self and partner funding. Observance of International and Australian standards for funding for partners in development projects.	Acquittal reporting for all partners funding for all activities. Reporting of all defaults on partner funding acquittals.

Table 5: Specific evaluative questions for the project[4][5]						
Project Outcomes	Specific Evaluative Questions	User	Indicator	Method	Responsibility	Timing
Intermediate outcomes						
Institutional or group practice change	Have country water managers adopted SWM policies and practices? XXX Are country agencies & departments upscaling and out scaling SWM practices? XXX Have WFs groups formed and are they accessing project information and participating in demo sites and SWM extension activities? XXX Have MTFs groups formed and are they accessing project information and participating in demo sites and SWM extension activities? XXX Is food security, livelihood or production/productivity/profitability changing in the target farmer groups from project interventions? XXX Are farmer groups established around the demo sites continuing to be a group post project?	NGOs and extensions staff. ACIAR. IWMI/USQ. Project management team. Institutions and government agency research teams.	Country agencies and major NGO SWM policies or programs developed at national, regional and/or local levels. Co authorship of papers. Number and type of WFs engaged and in leadership roles. Number and type of MTFs engaged (gender disaggregated). Number and type of resource owners engaged (gender disaggregated). Number of farmers applying SWM techniques for dry season crop production or other purposes (gender disaggregated). Key purposeful sample WF and MTF assessment of poverty, food security change since adopting SWM and dry season cropping (quantitative and qualitative information). Level of project information included in NGO and local extension service activities. Level of NGO participation. IWMI/USQ, ACIAR and country agency/NGO use of science and SWM techniques developed. Dry season irrigated crop productivity, production and profitability for WFs and MTFs targeted.	Review of policy change undertaken or planned and momentum developed for change. Appreciative Inquiry interviews of a purposeful sample (Women and men) of WFs, MTFs, resource owners as individuals and groups and key extension, NGO and departmental participating staff to establish their experiences of the project as reflected in their confidence, knowledge, practices and/or production/productivity/income change. Appreciative Inquiry interviews to continue through the life of the project and again 5 years after project completion. Project team, key partners and targeted WF, MTFs and resource owners to participate in the assessment of interview information (gender balanced).	Project management to establish 'purposeful sample' and commence Appreciative Inquiry interviews for agency, farmers, NGOs etc. The reference sites and farmer baseline survey results to be referenced to qualitative information. Project interviews to be incorporated into the 'post project impact assessment' evaluation approach.	From year 1 to completion. After project completion.

[4] Number of X's represents a vote of priority by workshop participants.

[5] Longer term outcome questions are the same as the overarching questions outlined above.

Table 5: Specific evaluative questions for the project[45]

Project Outcomes	Specific Evaluative Questions	User	Indicator	Method	Responsibility	Timing
Key individual practice change	Did project interventions catalyse individual WF or MTF or resource owner use of SWM techniques, dry season irrigated production? XXX Are lead WFs accessing project information and participating in demo sites and SWM extension activities? Are lead MTFs accessing project information and participating in demo sites and SWM extension activities? Are resource owners making contributions to fixed infrastructure to improve SWM and increase dry season cropping opportunities for farmers? XXX	WFs and MTFs NGOs and extensions staff. ACIAR. IWMI/USQ. Project management team. Institutions and government agency research teams.	Number WFs participating in SWM demos and research activities and sharing/adopting techniques during project implementation. Number MTFs participating in SWM demos and research activities and sharing/adopting techniques during project implementation (gender disaggregated). Number WFs and MTFs taking lead role in sharing information and experiences from their involvement in the project sites. Area, type, technology, production, productivity and profitability of additional dry season irrigated crops grown applying SWM techniques developed. Improvement in livelihood from adoption and/or home consumption of dry season irrigated crops grown with SWM techniques (gender disaggregated). Infrastructure improvements made by resource owners.	Purposeful sample and Appreciative Inquiry interviews of lead farmers and other key stakeholders throughout the life of the project. This needs to be matched to the base line survey data in conduct.	Project team.	Throughout project implementation.
Confidence, knowledge and skills change	Were there SWM practices developed during the project at demos sites? XXX Have lead WFs and MTFs and resource owners increased confidence and skills to use the new SWM and dry season cropping? XXX Did in country partners to ACIAR build their capacity on SWM research? XXX	NGOs and extensions staff. ACIAR. IWMI/USQ. Project management team. Institutions and government agency research teams.	Science publications of innovations. Practical demonstrations of SWM techniques. WFs and MTFs skill and confidence levels for using SWM techniques and dry season cropping. Training and capacity building evaluations. Ongoing programs of 'in country' partners.	Purposeful sample Appreciative Inquiry interviews of target WFs and MTFs and other participants throughout the life of the project. Review of new programs and policies of ACIAR partners. Tabulation of all records into the results chart at half yearly and annual reviews.	Project team.	Throughout life of project.

Table 5: Specific evaluative questions for the project[45]						
Project Outcomes	Specific Evaluative Questions	User	Indicator	Method	Responsibility	Timing
Access to information	How many WFs, MTFs, resource owners, local extension and NGO staff have been engaged in training, field events, demonstration site works, training and publication development (gender disaggregated)? XXX Did the results from the project become integrated in communication sources applied by departments, extension agencies and NGOs for use by WF/MTFs, NGOs, and extension staff? XXX Was awareness of SWM practice increased in WF/MTFs, agency, department and NGO staff? XXX	Project management team. [4] Institutions and government agency research teams.	Event attendance (gender disaggregated). Training session, group meetings, group discussions, one on one meetings held and field day attendances (gender disaggregated). Number and/or amount of Website, Facebook messages, district extension service notes, NGO base materials produced (gender disaggregated). Innovation in information distribution e.g. use of mobile tel. and text etc.	Purposeful sample Appreciative Inquiry interviews of WFs and MTFs and other participants throughout the life of the project. Recording of attendances (women, men, and youth) at all events. Website and Facebook placements and topics and responses received counted and recorded (gender disaggregated). Tabulation of all records into the results chart at half yearly and annual reviews (gender disaggregated).	All management and research and extension participants.	Half yearly and annually and continuously as appropriate.
Outputs						
	Were research outputs completed as planned? Were water management techniques suitable for WFs and MTFs and resource owners for dry season irrigated cropping developed and tested? XXX What was the impact of SWM practices developed on water/land resources and crops produced? XXX Were sites selected and were they the right sites?	WFs and MTFs NGOs and extensions staff. ACIAR. IWMI/USQ. Project management team. Institutions and government agency research teams.	Research outputs planned completed and successful. Peer reviewed papers, decision tools and published information produced. SWM techniques successfully and unsuccessfully demonstrated in participation with farmers and resource owners. Additional dry season irrigated crop area, production, productivity, profitability of area eventually grown. Pattern of water use and availability pre and post project. Sites.	Annual reviews and activity/output reports Project reports on research outputs progress. Half term and annual review. Tabulation of all records into the results chart at half yearly and annual reviews. Technical and Appreciative Inquiry surveys of pattern of farmer water use and availability.	All management and research and extension participants.	Half yearly and annually and continuously.

Table 5: Specific evaluative questions for the project[45]						
Project Outcomes	Specific Evaluative Questions	User	Indicator	Method	Responsibility	Timing
Activities						
	Were field trials in participation with WFs, MTFs and resource owners, extensions services and NGOs completed as planned? XXX Were partnerships between stakeholders established as desired/planned? XXX Were key activities completed as planned?	WFs and MTFs NGOs and extensions staff. ACIAR. IWMI/USQ. Project management team. Institutions and government agency research teams.	Research activity progress – action commenced, survey work, field work, site selection, WF, MTF and resource owner selection and participation (Women and men), data access and acquisition, draft reports, final reports, information sharing. Level of engagement in training, extension and research activities including appropriate gender participation. WFs, MTFs and resource owners experience from participating in demo sites. Networks established between extension and NGO staff and farmer groups and farmers.	Project reports. Half term and annual review. Annual and midterm and final reviews and building of the progressive evidence base into the M&E plan results chart. Appreciative Inquiry survey (purposeful sample) of best practice WFs, MTFs and resource owners, NGO and extension service people.	Project team and leader.	Half yearly and annually and at project completion.
Inputs						
	Have all inputs been mobilised and if not why not? XXX Have resources utilised been acquitted and if not why not? XXX	ACIAR. IWMI/USQ. Project management team. Institutions and government agency research teams.	Partner's expertise, funding and resource contributions realised as scheduled. Agreements honoured to the full extent or partially. Funding grants and allocations acquitted by all partners.	Project reports. Half term review. Final independent review. M&E plan evidence assessment process by the steering committee and partners.	Project team and leader.	Half yearly and annually.

Getting Ready						
	Have all needed partnerships and relationships been established with project partners, departments, NGOs, resource owners and farmers? Were the right organisations engaged and target group of farmers identified? XXX Have standards for governance, monitoring, reporting, management (OHS, HR, performance), skills, training etc. been established and ethical clearance achieved? XXX Have the IPA, proposal, partner agreements, MOUs and timelines been agreed and contracts signed? Has an appropriate research/activity operational plan been developed? XXX Was funding received on time and inputs contracted provided? XXX	ACIAR. IWMI/USQ. Project management team. Institutions and government agency research teams.	Partnerships and relations established. Standard for governance of the project established across partners. IPA and M&E plan built collaboratively with partners. Contracts signed. Ethical clearance achieved. Partners engaged and participating. Operational plan. Funding distribution timing. Stakeholder engagement and communications plan.	Purposeful sample and Appreciative Inquiry interviews with WFs, MTFs, NGOs and Departmental people throughout the project. Final independent review. M&E plan evidence assessment process by the steering committee and partners. Project reports. Half term review.	Project team and leader.	After year 1.

I. Project Results Chart and Reporting Format.

Table 6. Overall results chart and reporting		
Outcome level and expected outcome	Narrative description of quantitative information from reports, reviews, evaluations, surveys and adoption.	Qualitative evidence from interviews and case studies etc.
Getting Ready Have all needed partnerships and relationships been established with project partners, departments, NGOs, resource owners and farmers? Were the right organisations engaged and target group of farmers identified? Have standards for governance, monitoring, reporting, management (OHS, HR, performance), skills, training etc. been established and ethical clearance achieved? Have the IPA, proposal, partner agreements, MOUs and timelines been agreed and contracts signed? Has an appropriate research/activity operational plan been developed? Was funding received on time and inputs contracted provided?		
	Results Statement[6]:	
Initial Outcomes		
Inputs Have all inputs been mobilised and if not why not? Have resources utilised been acquitted and if not why not?		
	Results Statement:	
Activities/ Outputs Were research outputs completed as planned?		

[6] A summary view of the meaning of the information presented in the two columns above.

Table 6. Overall results chart and reporting		
Outcome level and expected outcome	Narrative description of quantitative information from reports, reviews, evaluations, surveys and adoption.	Qualitative evidence from interviews and case studies etc.
Did we find water management techniques suitable for WFs and MTFs and resource owners for dry season irrigated cropping? What was the impact of SWM practices developed on water/land resources? Were sites selected and were they the right sites? Were field trials in participation with WFs, MTFs and resource owners, extensions services and NGOs completed as planned? Were partnerships between stakeholders established as desired/planned? Were key activities completed as planned?	Results Statement:	
Intermediate Outcomes		
Access to information How many WFs, MTFs, resource owners, local extension and NGO staff have been engaged in training, field events, demos site works, training and publication development (gender disaggregated)?		
Did the results from the project become integrated in communication sources applied by departments, extension agencies and NGOs for use by WF/MTFs, NGOs, and extension staff? Was awareness of SWM practice increased in WF/MTFs, agency, department and NGO staff?	Results Statement:	

Table 6. Overall results chart and reporting		
Outcome level and expected outcome	Narrative description of quantitative information from reports, reviews, evaluations, surveys and adoption.	Qualitative evidence from interviews and case studies etc.
Confidence knowledge and skills change Were there SWM practices developed during the project at demos sites? Have lead WFs and MTFs and resource owners increased confidence and skills to use the new SWM and dry season cropping? Did in country partners to ACIAR build their capacity on SWM research?		
	Results Statement:	
Key individual practice change Did project interventions catalyse individual WF or MTF or resource owner use of SWM techniques, dry season irrigated production? Are lead WFs accessing project information and participating in demo sites and SWM extension activities? Are lead MTFs accessing project information and participating in demo sites and SWM extension activities? Are resource owners making contributions to fixed infrastructure to improve SWM and increase dry season cropping opportunities for farmers?		
	Results Statement:	
Institutional and group practice change Have country water managers adopted SWM policies and practices? Are country agencies & departments upscaling and out scaling SWM practices? Have WFs groups formed and are they accessing project information and participating in demo sites and SWM extension		
	Results Statement:	

Table 6. Overall results chart and reporting		
Outcome level and expected outcome	Narrative description of quantitative information from reports, reviews, evaluations, surveys and adoption.	Qualitative evidence from interviews and case studies etc.
activities? Have MTFs groups formed and are they accessing project information and participating in demo sites and SWM extension activities? Is food security, livelihood or production/productivity/profitability changing in the target farmer groups from project interventions? Are farmer groups established around the demo sites continuing to be a group post project?		

Longer term outcomes		
Has there been an improvement (or is one expected) in livelihoods of targeted women and marginal tenant farmers in the Eastern Gangetic Plains from dry season irrigated cropping applying improved SWM practices? Why or why not?		
	Results Statement:	
To what extent has poverty been reduced and/or food security increased among women and marginal tenanted farmers from dry season irrigated cropping applying improved SWM practices? Why or why not?		
	Results Statement:	
Has there been an increase in dry season irrigated cropping production among women and marginal tenant farmers through improved SWM practices being applied or possible? Why or why not?		
	Results Statement:	
Did relevant country government agencies, NGO's and extension organisations adopt SWM policies and extension programs, if so why and if not, why not?		
	Results Statement:	

Attachment 1. TOR for Contract to Develop a Participatory Impact Pathway Analysis (PIPA) and M&E Plan

Australian Government
Australian Centre for International Agricultural Research

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Canberra ACT 2601
ACIAR House, 38 Thynne Street
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E aciar@aciar.gov.au
ABN 34 864 955 427

Contract No: [C2013/237]

12 June 2014

Mr Ted Rowley
Strategy Evaluation and Engagement
for Development Pty Ltd
PO Box 175
Jindabyne NSW 2627

Dear Mr Rowley

The Commonwealth of Australia represented by the Australian Centre for International Agricultural Research (ACIAR), wishes to enter into a Contract with Strategy Evaluation and Engagement for Development Pty Ltd ABN 33 155 822 870 to provide the Services specified in this contract, on the terms and conditions set out below in Attachment A – General Conditions of Service.

1. Provision of Services

1.1 The Services to be provided are to attend a project planning meeting in Kathmandu, Nepal, 7-8 July 2014 and an Inception meeting in New Delhi, India late August 2014 for ACIAR Project LWR/2012/079 *Improving dry season agriculture for marginal and tenant farmers in the Eastern Gangetic Plains through conjunctive use of pond and groundwater resources* to provide impact pathway analysis for the Project. The deliverables to be provided are:

(a) A preliminary Impact Pathway analysis and monitoring and evaluation framework for the project; and

(b) A participatory Impact pathway analysis and monitoring and Evaluation plan for the Project.

Attachment 2. Project M&E Definitions

'Building a Participatory Impact Pathway Analysis (PIPA) and an Monitoring and Evaluation (M&E) Plan' Workshop – Kathmandu 17/09/2014

Evaluation:	Is a process of information collection that tends to focus on the impact of our activities – defined as the 'systematic investigation of the merit or worth'. The term evaluation in this context encompasses periodic assessment of the policy, program or project 'through a set of applied research techniques to generate systematic information that can help improve performance'.
Monitoring:	The regular collection and analysis of information to assist timely decision making, ensure accountability and provide the basis for evaluation and learning. It is a continuing function that uses methodical collection of data to provide management and the main stakeholders of an ongoing project or program with early indications of progress and achievement of objectives.
Impact pathway:	Is a conceptual plan that articulates the rationale behind a program – what are understood to be the cause-and-effect relationships between activities, outputs, intermediate outcomes and longer term outcomes.
Impact Pathway Analysis	Mapping a theory of change of how a project will bring about impact, that is, mapping of the interactions that need to occur between researchers and the end users of the research outputs in order to achieve the desired development outcomes.
Participatory Impact Pathway Analysis (PIPA):	PIPA engages stakeholders in a structured participatory process, promoting learning and providing a plan for 'action–research' on processes of change to achieve the planned outcomes. A project design and management approach where the participants in a project including project staff, key stakeholders and beneficiaries together co-construct their program theory.
Outcomes:	Changes in practices, products or policy that result from adoption of the outputs by initial, next and final users—final outcomes are the changes experienced by the final users as a result of their adoption of the output.
Outputs:	Results of the R&D activities that can be adopted or are inputs into further R&D; these may be intended or unintended and can be a by-product.
Inputs:	The cash and in-kind expenditures on R&D and extension to deliver outputs to the initial (and sometimes final) user.
Assumption:	Any external factor (such as an event, condition or decision) that could affect the progress or success of a program, largely or completely beyond the control of program/project managers. Critical assumptions are those conditions perceived to threaten the implementation.
Evaluation questions:	These questions link to the outcomes in the different levels of the impact pathway both overarching and specific questions and to the six key evaluation question categories—appropriateness, impact, effectiveness, efficiency, governance and legacy.
Key evaluation question:	The question to be addressed in order to assess the worth or significance of a project, program or initiative in relation to its goals. This overarching question frames the evaluation and usually includes a selection from appropriateness, impact, effectiveness, governance, efficiency and legacy questions.
Contribution:	Contribution Analysis is an approach for assessing causal questions and inferring causality in real-life program evaluations.
Indicator:	A quantitative or qualitative factor or variable that provides a simple and reliable basis for assessing achievement, change or performance. It is a unit of information measured over time that can help answer questions.
Appropriateness/relevance:	A determination made through comparing the program with the needs of the intended beneficiaries.
Effectiveness:	A measure of the extent to which a program, project or initiative has attained, or is expected to attain, its relevant objectives efficiently.
Efficiency:	The notion of getting the highest value out of program or project resources.

Governance:	"—the set of responsibilities and practices, policies and procedures, exercised by an agency's executive, to provide strategic direction, ensure objectives are achieved, manage risks and use resources responsibly and with accountability';
Impact:	A change in the condition of biophysical, social, economic and/or institutional assets/circumstances. An impact may be positive or negative, primary or secondary, short term or long term, direct or indirect, and/or intended or unintended.
Legacy:	The enduring consequences of past investments, policies or actions that can be captured and/or bequeathed.
Capacity Development:	". . . the process of developing competencies and capabilities in individuals, groups, organisations, sectors or countries which will lead to sustained and self-generating performance improvement".
Qualitative Information:	Verbal and other information such as minutes from meetings, interviews and observation notes. Qualitative data describe people's knowledge, attitudes, experiences and/or behaviours.
Quantitative Information:	Data and information measured or measurable by, or concerned with, quantity and expressed in numbers or quantities.

Attachment 3. Workshop Program (Amended)

Improving water use for dry season agriculture by marginal and tenant farmers in the Eastern Gangetic Plains

September 17-19, 2014. Summit Hotel, Kathmandu, Nepal. Program and Agenda Inception and Planning Meeting

DAY 1

Schedule		Activity	Remarks
September 17, 2014		Inception Meeting	
8:30	9:00	Registration	
9:00	10:45	Session 1 Inception Meeting	Chair Erik Schmidt - USQ
9:00	9:10	Introductory remarks	Erik Schmidt, Project Leader
9.10	9.20	Official Welcome	Minister of DOI
9.20	9.30	Official Welcome	Glen White Australian Ambassador, Nepal
9.30	9.40	Importance of Study in context of EGP	Evan Christen, ACIAR
9:40	9:50	Relevance of project to County priorities.	Nepal Representative
9:50	10:00	Relevance of project to County priorities.	India Representative
10:00	10:10	Relevance of project to County priorities.	Bangladesh Representative
10:10	10:30	Goal and Vision of Project and Project Overview	Erik Schmidt, Project Leader
10:30	10:45	Introducing the Project Partners and Team	Fraser Sugden, IWMI/USQ
10:45	11:15	TEA	
11:15	13:00	Session 2 Engaging the Partners	Chair Fraser Sugden
11:15	12:15	Brief 5 minutes introduction from each partner on their vision for the project, their contributions and expectations	CSIRO, UBKV, CDHI, ICAR, Sakhi, DoI, NGRDB, iDE, BRRI, NUS
12:15	12:35	Summary of Project Activities	Erik Schmidt - Introduction ; Fraser Sugden ; Michael Scobie ; Romulus Okwany
12:35	12:55	Discussion	ALL
12:55	13:00	Vote of Thanks	Evan Christen ACIAR
13:00	14:00	LUNCH	
		Departure of Delegates from Inception Meeting	
14:00	15:45	Session 3 Communication, Engagement and Capacity Development	Ted Rowley and Jo Roberts (Facilitators)
14:00	14:30	Travel to Field Site	
14:30	15:00	Site Visits	
15:00	16:00	Developing a communication, engagement and capacity development strategy and plan	All
16:00	16:15	TEA	
16:15	18:00	Session 4 Team Building	Ted Rowley and Jo Roberts (Facilitators)
16:15	17:30	Impact Pathway Analysis IPA roleplay	All
17:30	18:00	Travel to Hotel	
18:30	20:30	DINNER	

DAY 2

Schedule		Activity	Remarks
September 18, 2014		Planning Meeting	
9:00	10:45	Session 1 Impact Pathway	Ted Rowley and Jo Roberts (Facilitators)
9:00	9:30	Impact Pathways and Monitoring and Evaluation (Introduction)	All
9:30	10:45	Development of Project Impact Pathway from Goals and Outcomes.	All
10:45	11:00	TEA	
11:00	13:00	Session 2 Impact Pathway and Monitoring and Evaluation	Ted Rowley and Jo Roberts (Facilitators)
11:00	12:00	Further Development of Project Impact Pathway from Goals and Outcomes.	All
12:00	13:00	Development of an M&E Plan based on IPA.	All
13:00	14:00	LUNCH	
Session 3		Session 3 Monitoring and Evaluation	Ted Rowley and Jo Roberts (Facilitators)
14:00	16:00	Development of an M&E Plan based on IPA.	All
16:00	16:15	TEA	

Session 4		Session 4 Project Planning	Chair Evan Christen
16:15	16:45	Project Objectives	Erik Schmidt, Fraser Sugden, Mike Scobie
16:45	17:15	Project Activities	Fraser Sugden, Mike Scobie, Romulus Okwany and Mohammed Mainuddin
17:15	17:45	Discussion and Questions	All
18:30	20:30	DRINKS and BBQ	

DAY 3

Schedule		Activity	Remarks
September 19, 2014		Planning Meeting	
9:00	10:45	Session 1 Detailed Planning	Chair E Schmidt
9:00	9:20	Case Study of engagement and interventions for a site	Mike Scobie , Romulus Okwaney, Fraser Sugden
9:20	10:00	Example interventions (biophysical and social)	Contributions from various Partners
10:00	10:20	Discussion of envisioned activities	All
10:20	10:45	Site Selection Criteria	Fraser Sugden
10:45	11:00	TEA	
11:00	13:00	Session 2 Regional Discussions	Chair and Recorder Regional Partners
11:00	13:00	Breakout Groups (Regional focus) Discuss: Envisioned Roll out of Project (focus on Objective 3 - Village Pilot Studies). Discussion Points: • Village selection • Likely interventions • How will we work together • What do we want to achieve • How will we measure it. • Risks/Assumptions • Roles and responsibilities	Groups: West Bengal, Bihar and Nepal.
13:00	14:00	LUNCH	
14:00	16:00	Session 3 Work Planning	Chairs F Sugden and M Scobie
14:00	16:00	Detailed Work planning next 12 months Breakout Groups (Regional focus)	Groups: West Bengal, Bihar, Nepal, Bangladesh.
16:00	16:15	TEA	
16:00	17:00	Session 4 Concluding Arrangements	Chair E Schmidt
16:00	17:00	Discussion: *How do we share information between regions • Significant Risks for Project • Opportunities for training and capacity development • Role of Management Committee, Regional Coordinating Committee and Stakeholder Meetings and Schedules • Project Reporting and Financial Management and Administration – General	ALL
18:30	20:30	DINNER	

Attachment 4. Workshop Attendees for the PIPA and M&E Plan sessions

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Attachment 5. Impact Pathway Analysis Described

Impact Pathway Analysis (IPA)

An Impact Pathway Analysis is a conceptual plan that articulates the rationale behind a project – what are understood to be the cause-and-effect relationships between inputs, activities, outputs, intermediate outcomes and longer term outcomes. Represented as a diagram, an impact pathway analysis shows a series of expected essential consequences (Indicators of success), not just a sequence of events and can be described as a form of design clarification. IPA provides a 'theory of change' that can be tested and also helps to determine when and what to evaluate so that evaluation resources are used effectively and efficiently.

An M&E plan based on an IPA approach consists of;

- the IPA. It incorporates the key initial (inputs, activities and outputs), and intermediate outcomes (knowledge, practice and aggregate change) through which the ultimate outcomes are to be achieved;

that gives rise to

- the specific evaluation questions through which the overarching and key evaluation questions about the impact of the project in achieving its goal and outcomes can be answered, complemented by additional questions for each stage of the IPA design;

for which

- relevant performance information (indicators) is identified for collection at various times

and is used as the basis for developing

- an M&E plan for who will collect and report what information at what times. It also provides an overview of what relevant data is already available and what other data collection may be needed to address evaluation questions.

How do you do an IPA?

To develop IPA it is more strategic to start at the top, clarifying the longer term outcomes by asking what drives the returns or benefits to the target beneficiaries first, and then work downwards to activities and inputs. IPA can be applied at the project, program, program cluster or corporate level. There are various methods of IPA, often referred to as 'program logic' or the 'theory of change' and each method has a quite different emphasis.

Different flavours of IPA

There is little consensus with regard to terminology. Some people use terms such as 'program theory', 'program logic', 'IPA' and 'theory of action' interchangeably. Others may make the following distinctions:

- *Systems diagram* (input-process-output-outcome);
  - *Outcomes mapping (OM)* - As an evaluation approach, OM unpacks an initiative's theory of change, provides a plan to collect data on initial, basic changes that lead to longer, more transformative change, and allows for the plausible assessment of the initiative's contribution to results;
- *Bennett's Hierarchy* - an example of a generic program theory model for agricultural extension. The Hierarchy uses seven steps to describe how extension programs are thought to bring about change;
- *PIPA or program logic* - this is a diagram or table to represent the intermediate outcomes of a project or program or strategy. It starts with a blank sheet of paper, and the team develops a non-linear model based on group knowledge of the program; and
- *Logical plans or 'log frames'* – a matrix that asks questions at each level of a simple input, activity and output hierarchy. In addition to describing the outputs at each level of the matrix, log frames also include a column for measurable indicators.

When do you use IPA?

Ideally you would develop an IPA model during the development phase of a project or program or strategy and refine it as often as possible. However, an IPA model can also be developed for an existing program.

Why do an IPA?

There are three main reasons for developing an IPA: To

i. Evaluate or clarify the logic of the project or program or strategy intervention especially with partners, often when the project or program is in development, inception or re-development;

ii. Provide a plan for a plan for learning and improving through monitoring, evaluation and reporting on the performance of a project, program or strategy; and

iii. Provide a format to capture information and knowledge generated by the project specifically in regard to the impact of that knowledge on the target recipients in a formal manner.

Who develops the IPA for a program?

There are enormous benefits in drawing up IPA in a team including project proposers, beneficiaries, funders, managers and partners. These benefits include:

i. Helping the project team to gain a shared vision of what the project is trying to achieve;
ii. Gaining a shared understanding of how the sub-components fit together to bring about overarching outcomes; and
iii. Helping partners understand how their work fits in with the bigger picture.

Example IPA template.

Table 1: Example IPA template - WORK BACKWARDS FROM THE OUTCOMES TO BUILD IT!

Outcome level		Type of outcome
Goal 10 to 20 years	Vision Mission.	Statement of the overall vision.
Longer Term Outcomes 5 to 10 years	Improvements in the community, industry, environment, institution.	Expected outcomes relating to the condition of institutions, organisations, community, environment and industry as a result of intervention.
Intermediate Outcomes 1 to 5 years	Aggregate changes in interest group/s.	A change in types of organisational, institutional and community policy/behaviour/ practices resulting in group scale impact.
	Key individual practice change.	Adoption of practices by key or leading individuals or organisations.
	Attitude, confidence change.	Positive changes in confidence of organisations and key individuals to undertake a practice.
	Access to information, improvement in skills.	Improved access to information and acquisition of skills.
Initial Outcomes 1 to 5 years	Outputs	Activity outputs such as research reports, research products, plans, buildings, agreements, laws, systems, hardware or software.
	Activities	Activities are things that lead to outputs e.g. research, review, building, engagement, and training.
	Inputs	Resources, expertise.
Getting Started	Planning	Getting the right people in the project prepped; Conducting baseline assessments and analysing program evaluation results; and Agreements, plans, funding, participatory IPA undertaken.

Attachment 6. Key Evaluation Questions, Research Design Characteristics

Table 6. Potential key evaluation questions research designs.

Research Design & Method	Brief Description	When to use	Strengths - Weaknesses
Randomised Controlled Trials (RCT) RCT designs are where there is a control group and a treated group, often replicated.	Potential beneficiaries are randomly selected into an investment group that receives the investment and a control group that does not receive the investment.	Can be applied prior to the start of an investment. Probably best suited to simple cause and effect situations.	Offer the most rigorous of methods of establishing causal inference; however, may be difficult to implement. Control groups for more complex programs/projects are difficult to establish especially in developing countries. Subject to threats to external validity and some of the threats to internal validity.
Quasi-Experimental Designs Potentially including a range of design variations e.g. Pre-project and Post-project and longitudinal studies through time on the treated group/s and post-project- only designs.	Attempts to compare beneficiaries who have received the investment with an 'equivalent' control group. The evaluator attempts to minimise the differences between the two groups.	Appropriate where randomised assignment is not an option; can be applied to complex situations.	Takes creativity and skill to design, but can give highly accurate findings. Attention must be paid to addressing threats to internal validity. There are significant social and ethical risks in constructing control groups in developing country situations.
Non Experimental Direct Analysis or *Implicit Design* Focuses on the group receiving the treatment during and after treatment.	Examines only the group receiving the investment; usually only after an intervention has been implemented.	Used where a comparison group is not a feasible option.	Flexible to implement and can be used for exploratory research. Offer little objective evidence of the results. Best applied with multiple lines of evidence.
Mixed Design A combination of the above options where some component of the design may be a RCT or Quasi experimental and some not.	Utilises different evaluation designs to collect and assess evidence. Usually a mixture of implicit and quasi experimental but can also include RCT elements if possible.	Used where some baseline information exists collected in a rigorous way and research outputs are expected to lead to development outcomes.	Utilises the best of both quantitative and qualitative methods for collecting and assessing evidence. Some evidence will be quantitative and some qualitative both lots derived from rigorous techniques. Assessment of evidence is by statistical analysis as well as team and expert panel assessment.

Attachment 7. Appreciative Inquiry Technique

Appreciative Inquiry Technique and Semi Structured Interview Protocol and Questions recommended for the project M&E plan.

Appreciative Inquiry

Appreciative Inquiry is a participant-centred approach (as opposed to management driven) to M&E and supports implementation of change intended in the project being evaluated. "*Appreciative Inquiry is the study and exploration of what gives life to human systems when they function at their best". "This Approach to personal and organisational change is based on the assumption that questions and dialogue about strengths, success, values, hopes and dreams are themselves transformational*" (The Power of Appreciative Inquiry. D. Whitney & A.Trosten-Bloom, 2003).

Consider these two questions:

1. What problems are we having?
2. What is working around here, what has changed?

These two questions underline the difference between traditional change management theory in building capacity in groups and organisations and Appreciative Inquiry. The traditional approach to change (and when we reflect at the end of a project) is to look for the problem, do a diagnosis, and find a solution. The primary focus is on what's wrong or broken. Since we look for problems we find them. By paying attention to problems, we emphasis and amplify them[7]."

The theory behind this approach lies with the differences between 'complicated' and 'complex' environments within which change is targeted for achievement of development outcomes. Social change projects largely take place within 'complex' environments where cause and effect is not readily predictable and desired changes are often dependant on 'free will' being exercised, 'try and look for success' approaches are desirable. Projects conducted within a 'complicated' environment occur in circumstances where cause and effect are more predictable and 'plan, do, observe and correct' approaches work[8].

Appreciative Inquiry suggests that we look for what works and what changed. An alternate approach more suited to quasi experimental evaluation designs, the Most Significant Change Approach[9] to program evaluation, collects and analyses stories of "Significant Change" through time and often highlights what is "working" in a given program or project. The two approaches support each other.

Appreciative questions to be used in the project evaluation process

Appreciative Inquiry interview questions are written to uncover who and what a project or a program is when at its best. Consistent with the Appreciative Inquiry approach, the questions for the next evaluative step in the M&E plan are structured as follows:

- A title of the affirmative topic;
- A lead-in, that introduces the topic; and
- A set of sub questions that explore different aspects of the topic.

[7] The Thin Book of Appreciative Inquiry. S Annis-Hammond. 2nd edition, 1998.

[8] Source - Cognitive Edge Domains WWW, Cognitive-edge.com.

[9] The Most Significant Change Technique: A Guide to Its Use' by Rick Davies and Jess Dart (April 2005) Accessed: http://mande.co.uk/docs/MSCGuide.htm.

The sub questions suggested to be used (see below) can be structured as follows:

- Backward questions generally come first – these invite us to introduce ourselves and then remember high points or in this case, Stories of Significant Change;
- Inward questions generally follow backward questions and ask us to refer back to the high points (or Stories of Significant Change) and identify their root cause of success; and
- Forward questions generally come last and they ask us to look ahead and, in this case, identify future management decisions by WFs, MTFs and resource owners.

Question format

Introduction (by interviewer): (something like) "Thank you for meeting with me.
My name is ---------- and I have been requested to undertake a review of the project. I have a number of questions to ask you about your experience and knowledge about the project. These are broad questions and it will really be more like a chat. We may use some quotes/ stories from what you have said in the group forum and may put them into a report – but we will not put your name next to the quotes – so it will be anonymous, but not confidential. You may be identified in a list of people interviewed.

Thank you for your time.

Interview Questions:

1. Could you please tell me if you have been involved in the project and what are some of your experiences were in/of the project?
2. Could you tell me about the changes that occurred from your personal involvement in the project?
3. Thinking about those changes - which do you think is the most important and why was this change important to you?
4. Thinking forward, if the project ran again what would you do differently?
5. What else would you like to say?

Interviewee Permission

Do you the story teller:

Want to have your name on the interview (story) material?	Yes	No
Consent to us using your interview for preparing a performance story?	Yes	No

Contact Details:

Name of person recording the interview:
Name of story teller:
Position of story teller:
Project and location:
Date of record:
Permission to audio record the interview: Yes No

Appendix 5

Project Monitoring and Evaluation Reporting:

The project Monitoring and Evaluation Framework (Appendix 4) was developed at the inception meeting. The evaluation included:

1. Overarching questions that relate to whether the project achieved it's longer term outcomes. This is best judged post project.
2. Key evaluation questions to assess the project in terms of governance, appropriateness (relevance), effectiveness, impact, efficiency (benefit/cost) and/or legacy.
3. Specific evaluation questions about components of the project as developed in the inception workshop

These factors are discussed below.

Factors influencing achievement of outcomes

A number of assumptions, implicit in the project impact pathway, that affect achievement of outcomes, are discussed below:

- The project achieved much over the four-year period, with a strong commitment by partners to engage and create impact. The multi-disciplinary nature of the research provided a challenge that most staff embraced, and which proved enriching.
- While arrangements for project management, engagement of staff and partners, and resourcing were adhered to, the complex ACIAR > USQ > IWMI > Partner contractual arrangements were challenging. This resulted in delays in receipt of budget funds by partners, which affected timing of some inputs. Challenging tender procedures of government departments also delayed some equipment purchases. Furthermore, limited ACIAR funds were available for the project extension. The project relied on partner savings, as confirmed through acquittals, being re-allocated to a central pool for re-distribution and delivery. This created significant difficulty as budgets were closed off, with some unforeseen expenditures.
- Notwithstanding above, a wide range of appropriate interventions were initiated with target farmer groups, following a highly participatory process. There was great willingness of farmers and project researchers to engage in activities, which have generated key learnings on the opportunities for dry season agriculture by marginal farmers. The combination of NGO's, government and university research institutions in local delivery, while initially a challenge, proved of great benefit to the overall outcome.
- The farmer groups were generally cohesive and cooperative, and their capacity to resolve issues and overcome challenges strengthened over time, particularly in sites where there was strong group leadership and facilitation by local partners.
- Access to groundwater was not a constraint with the exception of (Kanakpatti, Saptari) which had low yielding aquifer's, and villages in NW Bangladesh, like Rajshahi where groundwater levels drop below access depth for shallow tube wells during dry season. Pond irrigation was rare given ponds hold limited water, dry up in summer and are reserved for more lucrative fish production or domestic usage and cultural purposes.
- Earthquakes in Nepal and political instability in the Nepal Terai affected engagement during the first two years of the project. Travel to Bangladesh was restricted through DFAT warnings
- The project team engaged extensively with stakeholder groups through meetings, focus group discussions, training events and stakeholder meetings and this formed the main and the most effective communication path. Engagement with government and other delivery agencies was primarily at a local level and the impact on policy and

its delivery has been somewhat less.

- There has been good achievement of intermediate outcomes with many examples of individual and local institutional practice change, through establishment of collectives, as outlined in project Case Studies, Chapter 8 of this report and in tables below. The project has demonstrated significant crop diversification and intensification (Chapter 7.4.6. and 7.4.7) with improved profitability, and production of a wide range of crops to improve household nutrition.
- Change and impact has primarily been at local community level, although good examples of scaling and broader impact have been demonstrated (Chapter 7). Four years is too short to deliver broader out and especially up scaling and institutional and policy alignment. This is an important aspect of ongoing work.
- There was good participation between countries, although the focus on collective farming was restricted to India and Nepal. Bangladesh provided good insights (Chapter 7.3.7 and 7.4.7), especially on innovations in agricultural water management that could have relevance to less developed irrigation communities in Nepal and India sites.

Overarching Evaluation Questions

A number of overarching evaluation questions are posed below. Evidence to answer these questions is based on various project reports, quantitative data and qualitative information, such as project case studies. The project steering committee and key partners reviewed this information as part of Year 4 (October 2018) annual review. Key Responses are included in the monitoring and evaluation reporting tables below.

a) Has there been an improvement in livelihoods of targeted women and marginal tenant farmers in the Eastern Gangetic Plains from dry season irrigated cropping applying improved soil water management (SWM) practices?
b) To what extent has poverty been reduced and/or food security increased among women and marginal tenanted farmers from dry season irrigated cropping applying improved SWM practices?
c) Has there been an increase in dry season irrigated cropping productivity, production and/or profitability among women and marginal tenant farmers through improved SWM practices being applied?
d) Did relevant country government agencies, NGO's, Local Government and extension organisations adopt SWM policies and extension programs?

The project has demonstrated good progress towards achieving the long-term goal of improving livelihoods of targeted women, marginal and tenant farmers in the Eastern Gangetic Plains, using improved dry season irrigated agriculture. Evidence of this is found in 37 case studies, from which 17 have been summarised in the document "Synthesized Case Studies" (2019) Report No 22. Diversification and intensification of cropping systems has been significant, with cropping intensities increasing in most sites from around 110% to above 200%. New cropping systems have resulted in increased profits (See Chapter 7.4.6 and 7.4.7) as well as improved household nutrition, as evidenced by the diverse range of vegetable crops grown. Improved cropping practices have been introduced, such as better crop selection and timing, fertiliser strategies and pest and disease management and improved tillage practices. Poverty has thereby been reduced and food security increased among targeted women and marginal farmers.

A range of improved soil and water management practices were adopted. These include improved irrigation systems (drip, sprinkler and ridge and furrow), better water distribution systems (poly pipe), improved irrigation management strategies (alternative wetting and drying, and irrigation scheduling), and improved pumping configurations (eg check valves, improved pump efficiency and introduction of solar pumps).

There has been good engagement with local government agencies, NGO's, and extension organisation. This has not yet translated into widespread adoption of project findings; however, local examples are evident. For example, in Madhubani stakeholder meetings have resulted in government initiating eight new minor irrigation infrastructure projects at Dhaloguri and new water user groups have been formed to manage each of these systems. Through CDHI, and sister project SIAGI, the project has connected with the West Bengal Accelerated Development of Minor Irrigation Project to support engagement and training.

Key Evaluation Questions

Selected key evaluation questions and responses are provided below. Evidence to answer these questions was also based on various project reports, quantitative and qualitative information, as well as project monitoring and evaluation reporting tables (see below). Further evidence can be found in project final report and annual reports and trip reports as well as financial statements and acquittals.

Impact: Achievement of longer-term outcomes planned.

- There have been significant changes to the livelihoods of target, woman, marginal and tenant farmers who have adopted improved dry season cropping and water management practices, as well as collective farming arrangements in Nepal and India. Crop diversification and intensification is evident with increased profitability. In some cases collectives disbanded, however in most cases they have evolved to a more sustainable model, and new collectives have formed voluntarily.
- Irrigation technologies, such as solar and drip irrigation, have a high capital cost and require more specialised maintenance which is in some case beyond the ability of marginal farmers. Simple technologies such as ridge and furrow irrigation, poly pipe water conveyance and irrigation scheduling often provide greatest benefit.
- High value vegetable crops provided good returns, but were at times risky in terms of market access and price. Some high value crops were prone to failure through pest and disease and variable weather conditions.
- There was good access to information, sharing of knowledge by participants and beneficiaries, which led to confidence change in targeted farmers and local NGO's (See tables below). There was less impact in policy change and change to research and extension agency implementation programs. This is not unexpected over such a short period.

Effectiveness: Achievement of project activities and outputs planned, using the inputs and techniques planned.

- Project inputs and activities have led to significant range of activities, across three countries, 12 villages and 35 sites, which has helped achieve the outputs and outcomes identified in the impact pathway (Figure 5.3.1) and discussed in tables below.
- Agreements were executed, resources committed and delivered and inputs, activities and research outputs achieved. Challenges in contracting and funding, especially in terms of the project variation, are discussed elsewhere. Engagement, communications and capacity building plans (Appendix 3) were adapted locally and delivered through a range of strategies (Section 5.2). Extension and training activities were comprehensive (Appendix 12) and there has been strengthening of knowledge and skills, and significant individual practice change (see tables below).

Appropriateness (Relevance).

- The program met the relevant needs of the intended beneficiaries, the combination of crops selected, and water management practices and irrigation technologies were appropriate for farmers. There was a strong focus on woman farmers and their representation in training events was 61% in India and Nepal and 52% in Bangladesh. Gender impact assessment has been a cornerstone of the project monitoring and evaluation (section 7.4.2).
- Farmer collectives have evolved into one of four models Section 7.4.1.3 and are showing resilience based on local experience and adaptation (See Case Studies Report No 22). New water management techniques have been adopted in Bangladesh ((Maniruzzaman et al (2019) Report No 23 and Mainuddin et al (2019) Report No 18) and in Nepal and India (Chapter 7.4.4 to 7.4.6 and Case Studies).

Legacy (Sustainability).

- The project has developed a credible pathway to impact framework. This was recognised in the mid-term review report that stated, "results have shown that the basic premises underpinning the impact pathways are correct, and that the project's research and stakeholder engagement strategies are proving to be effective. The results being generated by the project have the potential to lead to significant social and economic impacts".
- Farmers have formed into established collectives that have benefitted both woman and marginal farmers as well as landlords. While there is need for greater strengthening of collectives, and local institutions, the model adopted is showing promise (Section 7.4.1). The project has explored key drivers for collective strengthening, which will be published in a thematic based report (see Section 5.6.2).
- New multi-season cropping systems have been widely adopted, with demonstrated profitability (section 7.4.6 and 7.4.7). Farmers are adapting their practices, and crop selection strategies are evolving based on local experiences. There are examples of neighbouring farmers and villages adopting practices demonstrated at our sites.
- There has been good continuity in participation of farmers and willingness to try new methods and approaches even following setbacks, demonstrating resilience.

Efficiency – value for money from project resources

- The project budget $2.5m over 4.5 years has been allocated across three countries, twelve villages and twelve partners. Funds have driven a program, which is unique in its transdisciplinary focus and has laid a solid foundation to create change for marginal farmers in the EGP. This has required significant investment in field site establishment and engagement and capacity development of farmers. The project has added significant value to other projects and programs as demonstrated by interactions with ACIAR SIAGI project and SDIP initiatives and is well positioned to continue to do so.
- There has been good co-investment through IWMI and WLE program ($200,000) and partner salary contributions, as well as overheads not charged.
- There have been areas of research that have provided less value, including baseline water resource studies, and vulnerability assessments.

Governance

- Project management actions complied with the set of responsibilities and practices, policies and procedures, set by ACIAR through its contracts.
- Partner agency acquittals and reporting of ACIAR project funding allocations was open and transparent.
- As previously stated the complex contracting structure resulted in delays in receipt of budget funds by partners, and the need to use partner savings, as confirmed through acquittals, for re-distribution and delivery of the extension, created significant difficulties.

Project Results Chart (October 2018)

Overall results chart and reporting	
Outcome level and expected outcome	Evaluation .
Activities/ Outputs • Were sites selected and were they the right sites? • Were key activities completed as planned? • Were field trials in participation with WFs, MTFs and resource owners, extensions services and NGOs completed as planned? • Were research outputs completed as planned?	• Thirty five trial sites of collective farming in dry season are being successfully demonstrated. Irrigation equipment (drip, solar, sprinkler) etc finalised for all sites. • Extensive mobilisation and capacity development has supported this, primarily through NGO's. Improved SWM and irrigation techniques are being implemented on sites and scaled out to adjacent communities. • Good community engagement through activities with targeted gender participation. Targeted training plans and technical support underway. • Outputs completed as planned. (see Annual reviews and activity/output reports). • Twenty five draft reports and documents have been prepared. Ten conference papers have been presented and three journal papers prepared. Final research report structure has been developed and agreed. One draft policy brief prepared. • Documentation of case studies around a reporting framework has made good progress. 17 Case studies being finalised for report and overarching framework report being prepared using agreed themes.
• Were partnerships between stakeholders established as desired/planned?	• Networks have been established between NGO and Gov't staff and farmer groups. Broader expansion of networks through Stakeholder engagement and awareness activities has been mixed. • While key activities have been completed strengthening of linkages with agencies and supply chains has been inadequate in some areas. • Current activities have been intensive. The current model of engagement and demonstration support has probably run its time and new approaches to add value and scale WMTF operations are essential.
• Are our water management techniques suitable for WMTF's for dry season irrigated cropping developed and tested? • What has the impact of SWM practices been on our WMTF's?	• Dry season collective cropping under irrigation and improved SWM practices are showing much potential with water savings and increased production, diversification and profitability. • Biophysical monitoring of water resources at field trial sites continues through to end Rabi 18/19. • Water management techniques have generally been suitable for WMTF's. More "advanced" systems (eg drip, solar, plastic mulching, SRI, irrigation scheduling) have required greater support. Training has not always been appropriate or adequate and technical support has in some cases been inadequate. • Good success in some of the drip and drumkit applications that need to be promoted. • Scale of some systems (eg solar) needs to be larger for viability, an issue for smaller WMTF groups. Solar does provide generally low maintenance and woman friendly technology. Repairs and high capital costs are a barrier although cost of solar is reducing. • Many of the low investment options (eg ridge and furrow and plastic pipe distribution have been most successful) • The small scale of interventions makes commercial service support a challenge. Limited ability to negotiate prices or discounts on inputs. In some instances been good progress in registration of collectives to get access to subsidies and government support.

Overall results chart and reporting	
Outcome level and expected outcome	Evaluation .
	• Cost of some technologies is still prohibitive for small scale farmers. Access needs to be given to WMTF's to subsidies where available. • Pond irrigation and conjunctive water use have not been widely adopted owing to other uses for ponds, readily available groundwater and low storage volume and area that can be irrigated. • Owing to small scale of activities, there has been little impact on groundwater resources while pond irrigation is limited. • Wide range of new cropping systems have been trialed. WMTF engagement in crop planning has generally been adequate. Crop agronomy support, pest and disease and market price have been main challenges. These override soil and water management aspects. Agronomic support has been good in some sites but less so in others, depending on partner capability. Increased profitability and productivity has been widespread but risk has increased with some new cropping systems. • Significant increase in area under cultivation and crop diversification. Food nutrition positively impacted. Profitability has varied. • Large amount of cost-benefit data has been collected. This has been a challenge given very small plots, farmer knowledge and has required care in interpretation. Broad trends are however invaluable.
	Results Statement: All field trial sites established and summer cropping systems and improved irrigation management practices implemented. Extensive mobilization and engagement under challenging social dynamics has occurred. Generally, water management techniques have been suitable for WMTF's however, some more technically advanced systems (drip, solar) and processes (SRI, scheduling) have been challenging. Low-tech solutions have had greatest impact. Crop intensification and diversification has been substantial resulting in improved production, profitability and nutrition. Owing to small scale of activities, there has been little impact on groundwater resources while pond irrigation is not significant. Scaling farming operations, strengthening supply chain linkages, better market prices and improved linkages with agency and government support has been limited and is a key current focus.
	Actions: • Finalise reporting by 30 June 2019 [Technical Scientific report chapters, ACIAR final report, individual project reports, policy briefs]: Mid Year report by Partners Dec 2018, • Increase appropriate training and technical support around irrigation technologies and establish links to service and maintenance providers. More participative and repetitive training required in key areas. • Improved agronomic support and establish better linkages to markets and better pricing information. • Finalise evaluation of crop production and economic trends and draw key conclusions. • Support collectives in registration for and access to support programs. • Increase feedback to farmers on findings and reflective learning. • Focus needed on strengthening collectives, adding scale and linkages with agencies and markets. • Mobilization of other neighboring farmers and support in group formation and crop diversification important. • Focus on scaling required. Land consolidation, institutional change, access to finance and supply chain strengthening.
Intermediate Outcomes	

Overall results chart and reporting	
Outcome level and expected outcome	Evaluation .
Access to information • Is attendance by WMTF increasing at training, field events, demonstrations? • Are the results from our project getting communicated to government line departments, extension agencies and other NGOs? • Has awareness of our project increased in agency, department and NGO staff?	• Woman, marginal and tenant farmers (WMTF's) engaged across 35 sites and 12 villages in Bangladesh, India and Nepal. • Large number of farmer group meetings and training events held. Details and numbers indicated in annual reports. Attendance has been stable. • Results are communicated mainly locally and informally to farmers and officials. • Ten conference presentations have provided research exposure. • Awareness of collective farming and SWM practices has increased locally (MWTF's and official) but less so outside the village and district. • Local participation with NGO's, departments and agencies remains strong however this doesn't generally translate into integration broader communication and implementation programs. • Better linkages need to be established with government agencies and programs. There have been some excellent examples where communications have resulted in recognition of collectives for support programs and delivery of government infrastructure programs. • Innovative use of social media (web site, Facebook etc) and internal communication through WhatsApp has been effective.
	Results Statement: Strong local engagement of target communities through local partners with informal communication. Local awareness has resulted but this has not been widespread. Expansion across broader communication platforms required. While there have been local successes, results have yet to become widely integrated in communication sources applied by departments and extension agencies.
	Actions: • Greater focus on documentation, information sharing through case studies, technical and policy briefs is required. • Local language documents need to be prepared. • Structured, focused, strategic engagement with key agencies required • Arrange demonstration events at each site and invite key stakeholders first quarter 2019. • High level workshop to disseminate findings to key stakeholders
Confidence knowledge and skills change • Were there SWM practices developed during the project at demos sites? • Have lead WMTFs and resource owners increased confidence and skills to use the new SWM and dry season cropping? • Are we as Project Partners building our capacity in research in our organisations?	• SWM practices have been initiated across 35 sites. Initially focused on improving traditional irrigation methods, system and management improvements have been implemented. • Participatory approach to select SWM practices have been adopted. In some cases, there has been "technology push" to guide farmers who have little or no knowledge of opportunities available to them. • There has been demonstrated improvement in confidence of WMTF's. Case studies provide documentation and examples. Adoption of dry season cropping and collective farming has been impressive. This has required substantial facilitation and capacity development. • Greater capacity for farmers to take on risk are an example of increased confidence. Farmers are in many cases expanding dry season cropping and investing in their own systems based on learnings from demonstration sites. • Need to consider who in the collective has improved confidence and knowledge. Important from a social justice perspective. Who is benefiting, individuals, leaders or group as a whole. • Significant focus has been on training and capacity development. Team have strived for participatory approaches. There is need to improve evaluation of effectiveness of training. • The role of the community leader is critical for increased confidence and dispute resolution

Overall results chart and reporting	
Outcome level and expected outcome	Evaluation .
	• Farmer training and technical support continues at all sites. These require continuous review and an adaptive approach. Different approaches to engagement and training occur across sites in accordance with partner capabilities. • The project has had a stronger focus on development than research in the research for development spectrum. • In country partners have confirmed substantial growth in internal capabilities and capacity. • Partners have grown in project management and data collection and research process. • There has not been much training and formal skill development in specific scientific areas. The type of data collected, given the demonstration sites, is not as appropriate for some research outputs. Notwithstanding there has been significant improved understanding in irrigation and water management practices. • Interface between technical and social aspects has been a challenge. All have advanced their capacity in this area. Many Partners have had limited experience in this type of participatory multi-focus and social-technological linked project. • Good sharing of experience occurs at annual forums, regional meetings.
	Results Statement: There has been demonstrated improved confidence by participating farmers and a credible program of training and capacity development has been delivered to support this. Capacity of partners has been strengthened particularly in delivery of research for development projects, social-biophysical interface, community engagement strategies and improved cropping systems and water management. Formal research training opportunities and scientist exchange have been limited as has engagement of post grad researchers.
	Actions: • Focus and target training programs around seasonal activities. • More exposure visits for farmers. • Budget needs to be allocated for specific training events and research staff exchange. • Incentives for professional staff to attend and present at conferences need to be considered. • Stronger postgrad and undergrad program linkages required
Key individual practice change • Did project interventions catalyse individual WMTF or resource owner use of SWM techniques for dry season irrigated production? • Are lead woman, marginal and tenant farmers accessing project information and participating in demo sites and SWM extension activities? • Are resource owners making contributions to fixed infrastructure to improve SWM and increase dry season	• Significant uptake of dry season production and SWM techniques under collective systems has been achieved as outlined in intervention reports and case studies. • Participation has been consistent at local farmer group meetings (typically held monthly) with demonstrated interest to learn and evaluate new dry season agriculture. Level of confidence varies but is growing in all cases. There is reluctance in some cases for collective systems under intensive dry season vegetable crops until confidence and trust has built. This has resulted in a range of collective models. • Resource owners and landlords are seeing value in collective farming systems and confidence is growing. In some instances there have been problems with withdrawal of sites. This has generally been driven by local disputes on access to land, tubewell's and ponds. • Farmers are participating in range of dry season cropping and SWM approaches. These include new dry season crops in Rabi and Summer, improved groundwater access, pond rehabilitation and conjunctive use, new irrigated systems (furrow, drip, sprinkler), solar pumping, improved crop water management (mulching, ridge and furrow, scheduling). • Local dissemination of information, farmer to farmer, has been most effective. • There is evidence of local outscaling of cropping systems and technologies based on sharing of experience from our demonstration sites.

Overall results chart and reporting	
Outcome level and expected outcome	Evaluation .
cropping opportunities for farmers?	• Improved profitability and productivity is evident however crop failure has occurred for agronomic or market failure reasons. • Sustainability of technology (solar pumps, drip irrigation etc) without hand holding of local partners is still questionable at some sites. • There is an ongoing need for training and support and linkages with other service providers will be important. • Training approaches have evolved and can still be improved around targeted, season relevant, participative demonstrations which are repeated regularly. • There has been demonstrated increase in cropped area, crop diversity, productivity and profitability. This has improved livelihood and home consumption of more nutritious crops. • Resource owners are in some cases contributing to input and maintenance costs of equipment. More work is required on improved financial models for expensive equipment. In some instances members of collective are unable to contribute to group funds. Profitability levels are low and surplus funds are used for family support (e.g. health and education)
	Results Statement: There has been substantial individual practice change. These have been through the establishment of collectives, and resulting expansion into dry season cropping systems through improved irrigation and water management practices. Participating WMTF's are accessing project information and participating in demo sites and there has been expansion into surrounding fields in the village. Resource owners are in some cases contribution to fixed infrastructure, however profitability is low and surplus funds are often used for other household expenses. There is thus some risk in sustainability of infrastructure. Increased scale and profitability will improve sustainability. There is need for ongoing training and support and better linkages to local institutions and service providers
	Action • Strengthening local institutions (farmer club, distribution centre) and development of community based services. • Improved technology handover and training/technical support. • Improved financial models for maintenance of equipment and to cover ongoing input costs. • Focus on training of lead farmers who can act as catalyst for ongoing change and improvement. • Better linkages with government schemes through demonstration and information transfer to government officials. • Strengthen linkages between WMTF's and farmer producer organizations and supply chain. Improve value add to existing crop production operations. • Better access to information (especially digital) on marketing, input costs, agronomic practices).
Institutional and group practice change • Are country water managers adopting Sustainable Water management (SWM) policies and practices? • Are country agencies & departments helping upscale and out scale SWM practices?	• There is no evidence yet of change in SWM policy. This is not unexpected as the impact of a four year project on a very localized scale on policy will be limited. It needs to be recognized that translating poliicies into practice faces a myriad of constraints and the policy performance is largely influenced by them. • Historically, implementation of policies on sustainable water management have typically been poor, with imbalance in focus on technology installation, with less focus on management and maintenance and community capacity development. • Our work and its impact is still localized. But has started in a small measure to interface with local agencies. • Our design has not been appropriately tuned to keep the interface growing and consolidating beyond local level stakeholder engagement. Local implementation and scaling will ultimately lead to better policy recognition.

Overall results chart and reporting	
Outcome level and expected outcome	Evaluation .
• Have Woman Marginal and Tenant Farmer (WMTF) groups all actively participating in demo sites. Are they sustainable and likely to continue after the project? • Is food security, livelihood or production/productivity/profitability changing in the target farmer groups from project interventions? • Are farmer groups established around the demo sites continuing to be a group post project?	• Outscaling is starting to occur at a local level by neighboring farmers and landlords are becoming aware of experiences and opportunities. This has required input from local partners who are providing support to broader interest groups. There is greater dialogue between farmers and landlords for the first time which has had positive outcomes. • Gender engagement has been mixed and in some cases have benefitted established woman leaders and less so other woman farmers. There have been some instances of unequal power relationships in mixed woman/men groups with negative effects on woman labour burden and financial loss. • With regards productivity, seasonal variations and the distribution for each collectives member must be assessed and compared to income as a wage labourer. • Local agencies and line departments have started to support farmer groups as a result of this project. This includes provision of subsidies and support for inputs (eg seed and fertilizer) based on registration of collectives as well as installation of new tubewells and pumps as part of government programs. • Registration of farmers with the government department is a prerequisite for support. This often requires land ownership. Support for marginal farmers is now possible through registration as a group and this is being facilitated by local NGO's. • Turnover of local agency and department staff and competing priorities are a challenge. • WF and MTF groups have formed and are actively accessing project information through local partners, meetings and forums. Case studies highlight examples of this. Good participation has occurred at demo sites. • Food security and production/profitability has improved from project interventions as evidenced by case studies and economic analyses. • Findings in Bangladesh have illustrated that water use efficiency by farmers is much better than widely believed and impacts on groundwater are not as bad as expected. There are opportunities to communicate this information once results are finalized through policy briefs and stakeholder workshops. • Continuation of groups after the project will depend strongly on ongoing NGO presence and further development of leadership in local farmer groups. Strengthening of local institutions to support the small collectives, in terms of market access, input supplies and agricultural support services will be critical. • Collectives have evolved in terms of structure into one of four models in response to local dynamics. Collective farming has been a challenging concept for many of the communities, especially in labour intensive time critical crops (e.g. vegetables). • Continuity of collectives will depend on continued improved productivity and profitability. Dry season crops have improved productivity and profitability however there has been increased risk through higher value specialized crops. Agronomic practices and market prices have been critical.
	Results Statement: Collective (group) practice change has been significant and generally positive. Institutional practice change, through policy or governemt extension programs, is not widely evident. Local out scaling through neighbor farmer interest is occurring and there are some examples of agencies & departments upscaling and out scaling SWM practices but these are localized. WMTF groups have formed and are accessing project information and participating in demo sites and SWM extension activities. Sustainability of these groups will require stronger local institutions and better linkages with markets and service providers. This will require a greater scale of production. Food security, livelihood and production/profitability has improved for most farmer groups following project interventions.

Overall results chart and reporting	
Outcome level and expected outcome	Evaluation .
	Actions: • Identify government programs and initiatives that would benefit from project experiences and engage with officials with clear plan. • Create and maintain policy dialogue through seminars and conferences and briefing papers. • Better consistent interface and linkages with agencies through sharing of our learnings. • Develop simple communication tools for policy makers. • Engagement with government to support registration at local office and access to subsidies and services for collectives. • Broader demonstration of our models for collectives and benefits through registration for government support. • Host key workshops to promote consolidated results of the project. • Strengthen supply chain linkages for scaling of interventions. • Stronger linkages with other farmer and producer organizations. • More open discussion of gender norms and roles and engagement with more diverse female farmers. More female staff in the project. • Better assessment of each members benefit in terms of labour input days, agricultural input costs and benefit (not just at a plot level). • Improved participatory analysis of benefits and a more systematic M&E approach. • Reformulation of plan and strategies for group and institutional practice change.

FOR ENUMERATOR:

Hi, My name is _____, and I am working for the International Water Management Institute (IWMI). We are conducting a research to understand the agricultural practices and issues faced by people in your village Koiladi / Kanakpatti and we would really value your perspective. The interview will be completely confidential, and if at any time you wish to stop the interview or not answer a specific question, this is entirely up to you. The interview will take about 45 minutes.

Do you have any question to us?

Would you be willing to talk with me?

Yes……..1

No……..2 (end of interview)

SECTION 1: IDENTIFICATION (fill in before interview)

Household number (from map)*:* ☐☐☐☐

101.Interview Date	Day:___ ___	Month:___ ___	Year:___ _____ ___
102. Start Time	___ ___: ___ ___	AM / PM	
103. End Time	___ ___: ___ ___	AM / PM	
104. Name of Interviewer:		107. VDC/Municipality:	
105. Village Name		108.Ward Name:	
106. District Name:			

109. Name of respondent: _____ 110. Sex: (M….1, F….2)……. ☐

111. Name of household head: _____ 112. Sex: (M….1, F….2)……. ☐

113. What is your age? (*Age in completed Years)*..... ☐☐

114. What is your caste/ethnicity?_____

115. Select Ethnicity Code:

Brahman/ Chhetri.....1	Terai Madhesi.....2	Dalits.....3	Newar.....4	Janajati.....5	Muslim.....6	Others.....7

116. Number of household members: _____

SECTION 2: HOUSEHOLD ROSTER

2a. Details of household members, including those wh o have migrated but continue to have financial links with the household

201. Person Id. (number from 1-7… add rows if necessary)	**202. Name** *(start with respondent)*	**203. Male....1 Female..2**	**204. Relationship to head of the household** Head.....1 Spouse.....2 Son/daughter.....3 Grand Child.....4 Father/mother.....5 Brother/sister.....6 Son/Daughter in law....7 Other 8	**205. Age (completed)**	**206. Reside currently with family? (for migrants)** Yes...1 No....2	**207. Marital status** Unmarried.....1 Married.....2 Divorced/ Separated.....3 Widowed/ Widower.....4	**208. Education level** (0).....1 1 to 10 (1-10).....2 Passed SLC.....3 Intermediate.....4 University.....5 Other (specify qualification _____).....6	**Main occupation and nature**		**211. Contribute to agricultural labour for this household?** All year.....1 Part of year.....2 Never.....3
								209. Main occupation **Please write code given below**	**210.** Regular.....1 Temp/Seasonal.....2 Not applicable.....3 Don't know.....999	

Code for Q209:

Agriculture/Livestock/Fisheries..... 01	Foreign employment.....05	Student.....09
Wage labour (agriculture).....02	Salaried job 06	Old age/unable to work/disable.....10
Wage labour (non agricultural).....03	Unemployed.....07	Other (specify) _____.....11
Business.....04	Household work.....08	

NOTE: A '**household'** is defined as all members eating and living together under one roof for at least 6 months in the year. Please probe for members that are living away from the house for more than 6 months but still receive money from or send money to members living in the house regularly. They are a part of the household as well. Single person households are to be included. Married daughters who continue to stay in the house and who satisfy the six-month criteria are considered to be household members. A married migrant son who sends money home is also included.

2b [Nepal only] Does any adult in the house **over 16 years not** have Nepali citizenship? Yes / No _____ If yes record person id: _____

2c. [Nepal only] Do they have citizenship of India? Yes / No _____

SECTION 3: LIVING STANDARDS AND ASSET OWNERSHIP

301. How much residential land does your house occupy? _____ (dhoor/ kattha/bigha)

302. Type of house construction (please tick): Pucca ____ Kachha _____

303. Does the household have a toilet of its own? Yes / No _____

304. Source of household water (please tick as many as applicable)

Purpose	Source				
	Hand pump	Tap	Pond	River	Other
Drinking					
Washing/Sanitation					
Livestock					

305. Asset Ownership

Asset type (livestock)	No. of units owned	Asset type (consumer goods and property)	No. of units owned
a. Cows		e. Pressure cooker	
b. Buffaloes		f. Fridge	
c. Ox		g. Gas stove (include biogas)	
d. Goats		h. TV	
e. Pigs		i. Motorbike	
		j. Cycle rickshaw	

SECTION 4: RENTAL OR OWNERSHIP OF PRODUCTIVE IRRIGATION ASSETS IN LAST YEAR

Technology type	Owned equipment				Rented equipment		
	401 Number of units owned	402 Are any rented to others (Y/N)	403 Rented out unit of payment Per hour.....1 Per land unit ...2 Others (specify).3	404 Rate received per unit	405 Technology rented from same seller throughout year or more than one? State number of sellers	406 Rented unit of payment Per hour.....1 Per land unit....2 Others (specify).3	407 Rate paid per unit
a. Electric pump set (motor)							
b. Diesel pump set							
c. Other pump set							
d. Tubewell							
d. Micro-irrigation technology (e.g. drip system/sprinkler/ treadle pump)							
e. Irrigation/Fish Pond							

(Note to enumerator: Please specify land unit if applicable)

RENTAL OR OWNERSHIP OF OTHER AGRICULTURAL ASSETS

Technology type	Owned equipment		410 Do you rent this from others? (Y/N)
	408 Number of units owned	409 Are any rented to others? (Y/N)	
a. Thresher			
b. 2-wheel tractor			
c. 4-wheel tractor			
d. Plough			

411 What other agricultural or irrigation technologies have you heard of?	412 Why have you not used it until now? (More than one answer possible)
1.	
2.	
3.	
4.	
5.	

Code for Q412

Reason for not using technology/ not using as much as would have liked to	Code	Reason for not using technology/ not using as much as would have liked to	Code
Don't need to	1	Plots too far away	5
Don't know how to	2	Too expensive	6
Plots are too small	3	Inputs not available	7
Plots are too dispersed	4	Technology not effective, inefficient	8

SECTION 5: AGRICULTURE AND LAND CHARACTERISTICS

For owned land:	**For rented land:**
501 How much land do you have? _____ (dhoor/kattha/bigha)	504 How much land do you rent? _____ (dhoor/kattha/bigha)
502 How many plots is the land made up of? _____	505 How many plots is the land made up of? _____
503 Is any of the land owned by a woman member of the household? _____ (Y/N)	

FILL IN THE TABLE BELOW ON AGRICULTURAL LAND USE OVER LAST YEAR

	About plot			**Tenure of land**			**Only for rented land**										
Plot no.	**506 Distance from home (mins walking)**	**507 Area of plot**	**508 Area unit** (bigha, katta, acre etc)	**509 Tenure of land (please tick)**			**510 Details of rented tenure**				**511 Rental tenure security**		**512 Who is landlord for rented plots**	**509 % landlord contribution to costs of the following**			
				a. Owned and **cultivated** (>>skip rest)	b. Owned and **rented out** to others (>>skip rest)	c. Rented from others (>>506)	a. Share-cropped (note crop %)	b. Fixed crop payment/ Tekka (note amount)	c. Fixed cash amo-unt	d. Other	a. No. of months plot has been rented	b. Official tenancy paper Yes..1 No...2	Absentee.....1 Local.....2 Relative.....3	a. Irrigation	b. Fertilizer	c. Labour	d. Other (Specify)

SECTION 6: CROP PRODUCTION PER PLOT

601.For **monsoon** season (most recent autumn harvest). Include different varieties of rice as separate crops.

A. Plot number	**B. Crops planted in last monsoon**	**C. Area cultiv-ated (state unit)**	**D. Yield (kg/ mon/ quintal)**	**E. How much sold? (kg/ mon/ quintal)**	**F. Price per unit (kg/ mon/ quintal))**	**G. Type of irrigation (please tick)**								**H. Pump set used? (tick √ ownership status and note horsepower of pump, hours of operation)**					**I. No of water applications per crop**	**J. Average depth of water during each application (in inches)**
						a. Tube well		b. Pond		c. Canal	d. Other (specify)	e. None	f. Irrigation fee charged for canal use (if any)	a. Pump type Diesel….1 Electric..2 Others…3	b. Owned or rented?		c. Horse-power of pump	d. No. of Hours of pump operation per application		
						i. Owned	ii. Rented	i. Self owned	ii. Owned by others / Community						i. Owned	ii. Rented				

602.For **each crop** listed above, give information on the inputs used:

A. Crop	**B. Machinery**		**C. Use of non-household labour**								**D. Inputs applied to field**							
	a. Thresher (tick √ if used)	b. Tractor (tick √ if used)	a. Ploughman with ox		b. Tractor driver		c. Nursery plots, planting and weeding		d. Harvest		a. Seed variety		b. Manure (kg)	c. DAP (kg)	d. Urea (kg)	e. Potash (kg)	f. Pesticide (litres)	g. Others (specify)
			i. Y-1 N-2	ii. Man days/ season	i. Y-1 N-2	ii. Man days/ season	i. Y-1 N-2	ii. Man days/ season	i. Y-1 N-2	ii. Man days/ season	i. Name	ii. Kg						

603.For **winter** (most recent spring harvest) note information on the crops planted and the irrigation used on each plot.

A. Plot number	**B. Crops planted in last winter**	**C. Area cultiv-ated (state unit)**	**D. Yield (kg/ mon/ quintal)**	**E. How much sold? (kg/ mon/ quintal)**	**F. Price per unit (kg/ mon /quintal)**	**G. Type of irrigation (please tick)**								**H. Pump set used? (tick √ ownership status and note horsepower of pump, hours of operation)**					**I. No of water applications per crop**	**J. Average depth of water during each application (in inches)**
						a. Tube well		b. Pond		c. Canal	d. Other (specify)	e. None	f. Irrigation fee charged for canal use (if any)	a. Pump type Diesel….1 Electric..2 Others…3	b. Owned or rented?		c. Horse-power of pump	d.No. of Hours of pump operation per application		
						i. Owned	ii. Rented	i. Self owned	ii. Owned by others/ Community						i. Owned	ii. Rented				

604. For **each crop** listed above, give information on the inputs used:

A. Crop	B. Machinery		C. Use of non-household labour								D. Inputs applied to field							
	a. Thresher (tick √ if used)	b. Tractor (tick √ if used)	a. Ploughman with ox		b. Tractor driver		c. Nursery plots, planting and weeding		d. Harvest		a. Seed variety		b. Manure (kg)	c. DAP (kg)	d. Urea (kg)	e. Potash (kg)	f. Pesticide (litres)	g. Others (specify)
			i. Y-1 N-2	ii. Man days/ season	i. Y-1 N-2	ii. Man days/ season	i. Y-1 N-2	ii. Man days/ season	i. Y-1 N-2	ii. Man days/ season	i. Name	ii. Kg						

605. For the **summer** season (most recent pre-monsoon harvest) note information on the crops planted and the irrigation used on each plot.

A. Plot number	B. Crops planted in last summer	C. Area cultiv-ated (state unit)	D. Yield (kg/ mon/ quintal)	E. How much sold? (kg/ mon/ quintal)	F. Price per unit (kg/ mon /quintal)	G. Type of irrigation (please tick)								H. Pump set used? (tick ∨ ownership status and note horsepower of pump, hours of operation)				I. No of water applications per crop	J. Average depth of water during each application (in inches)
						a. Tube well		b. Pond		c. Canal	d. Other (specify)	e. None	f. Irrigation fee charged for canal use (if any)	a. Pump type Diesel….1 Electric..2 Others…3	b. Owned or rented?		c. Horse-power of pump	d. No. of Hours of pump operation per application	
						i. Owned	ii. Rented	i. Self owned	ii. Owned by others/ Community						i. Owned	ii. Rented			

606. For **each crop** listed above, give information on the inputs used:

A. Crop	B. Machinery		C. Use of non-household labour								D. Inputs applied to field							
	a. Thresher (tick √ if used)	b. Tractor (tick √ if used)	a. Ploughman with ox		b. Tractor driver		c. Nursery plots, planting and weeding		d. Harvest		a. Seed variety		b. Manure (kg)	c. DAP (kg)	d. Urea (kg)	e. Potash (kg)	f. Pesticide (litres)	g. Others (specify)
			i. Y-1 N-2	ii. Man days/ season	i. Y-1 N-2	ii. Man days/ season	i. Y-1 N-2	ii. Man days/ season	i. Y-1 N-2	ii. Man days/ season	i. Name	ii. Kg						

SECTION 7: LAND PURCHASES AND SALES IN LAST 10 YEARS

701. Land bought in last 10 years				702. Land sold in last 10 years			
A. Area (Dhoor/ Kattha / Bigga)	B. When bought Month/year	C. Bought from Local person.....1 Someone outside village...2 Family member.....3	D. Reason for purchase	A. Area (Dhoo/ Kattha/ Bigga)	B. When sold Month/ year	C. Sold to Local person.....1 Someone outside village...2 Family member.....3	D. Reason for sale

SECTION 8: LABORING INCOME SOURCES IN LAST YEAR

801. Person ID	802. Agricultural Labour: On other's farm				803. Factory Labour				804. Other off-farm labour				
	A. Daily wages	B. Total number of months	C. Approx. number of days worked per month	D. Approx. annual income	A. Daily wages	B. Total number of months	C. Approx. number of days worked per month	D. Approx. annual income	A. Type of labour	B. Daily wages	C. Total number of months	D. Approx. number of days worked per month	E. Approx. annual income

SECTION 9: INCOME

901. What is the total value of income generated by household members over the **past 12 months** from the following activities?

Circle if applicable	Income Type	Amount (Rs)	**Circle if applicable**	Income Type	Amount (Rs)
1	Wage income (from skilled salaried income)		5	Micro-enterprise / Business	
2	Crop or livestock product sales		6	Pension/Cash transfers from government schemes	
3	Rental income from house, land or commercial estate		7	Remittances from migrants	
4	Rental income from agricultural assets (animals, tractor, thresher, other machinery)		8	Others: please state _____	

SECTION 10: RECURRING NON-AGRICULTURAL EXPENSES

ENUMERATOR: Please write the expenses referring to the time frame mentioned below.

1001. In the **last month** did your household spend money on any of the following?

If respondent cannot recall only then list from options below

1 Less than Rs 500
2 Rs. 500-1000
3 Rs. 1000-2000
4 Rs. 2000-5000
5 More than Rs. 5000

S.No.	**Expense (please circle)**	**Amount spent**
1	Food for your family	
2	Education fees	
3	Tobacco, paan, beedi, alcohol	
4	Fuel for cooking	
5	Fuel for motorbike/scooter	
6	Electricity bill	

1002. In the **last year** did your household spend on any of the following?

If respondent cannot recall only then list from options below:

1 Less than Rs 1000
2 Rs. 1000 - 5000
3 Rs. 5000 – 10,000
4 Rs. 10,000 – 20,000
5 Rs 20,000-50,000
6 50,000 – 1 lakh
7 More than 1 lakh

S.No.	Expense (please circle)	Amount spent
1	Household appliances or durable goods (such as mobile phone, TV, radio, fan etc.)	
2	Agricultural equipment (e.g. tractor)	
3	Irrigation (pumps, tubewells)	
4	Purchasing animals	
5	House maintenance/improvement	
6	Wedding/saving for wedding	
7	Healthcare/medical	
8	Clothing and jewellery	
9	Put aside in a savings account or any other savings system	

SECTION 11: ACCESS TO CREDIT

1101. Have you taken a **loan in the last year** or do you have any outstanding loans?

Yes.....1
No.....2 (>>GO TO SECTION 12)

1102. Debt and loans (unpaid)

Source of Loan	Purpose of loan	Total value of debt to be repaid	Rate of interest (per year)	Repayment period
A. Bank				
B. Micro-credit bank				
C. Other private lender (eg. Landlord)				
D. Family Member				
E. Cooperative Group				
F. Others (specify) _____				

SECTION 12: TRAINING AND EXTENSION

1201. How many agricultural trainings have your household members attended in the last year? _____ Note the person codes _____

1202. How many times have your family members met an extension officer in the last year? _____ Note person code _____

1203. In case of tenant farmers: Has landlord visited in the last year?Yes.....1 (>>1204)

No.....2 (>>SECTION 13)

204. How many times in the last year did the landlord visit? _____

1205. Did the landlord provide any advice about farming practices? Yes.....1

No.....2

SECTION 13: SOURCES OF KNOWLEDGE ABOUT FARMING

No.	Question	Answer (circle)
1301	When you need farming advice, who do you receive it from most frequently? (please circle all that apply)	Father .....1 Spouse .....2 Farmer group .....3 Shopkeeper/input supplier.....4 Son/daughter .....5 Other family member.....6 Fellow farmer.....7 Friend .....8 Panchayat/VDC leader .....9 Extension agent .....10 Other.....12
1302	Are any of your family members a member of a farmer group?	Yes .....1 (Note person code _____) No .....2 **(>>1306)**
1303	How many years have you/they been a member of this farmer group?	_____Year/s
1304	Are you a leader of the farmer group?	Yes .....1 No 2
1305	What activity of the farmer group is most beneficial to you?	Sharing farming advice.....1 Sharing marketing advice.....2 Social activities.....3 Shared use of technology.....4 Shared marketing.....5 Opportunity for training.....6 Other.specify _____7
1306	Are you or anyone in your family, a member of any other type of community organization?	Yes .....1 (Note person code _____) No 2
1307	Do you attend any other meetings to discuss local water issues?	Yes .....1 No 2
1308	If yes, then how often do you meet in a year?	_____ (write the number)
1309	Would you say that you have made any major changes in your farming practices in the past 5 years, e.g. changed crops or cropping pattern, changes irrigation practices, etc.?	Yes.....1 No.....2

SECTION 14: SHOCKS

1401. Has your household experienced any of the following shocks in the last 5 years?		**1402. If yes, number of times shock was experienced in the last 5 years**	**1403. How severe was the impact for you?** Mild.....1 Moderate...2 Severe.....3	**1404. Response to shock (More than one answer is possible. Note in order of importance) [Insert code]**	**1405. Did the shock result in loss of income?** Yes....1 No.....2
Shock	Yes…1 No…..2				
i. Drought (Amount of rain during growing season was significant below normal or deviated from expected period)					
ii. Untimely rains (Rain arrived too early or to late, affecting sowing, planting or harvest operations)					
iii. Irregular weather					
iv. Hailstorm					
v. Flood (Heavy rains causing flooding situation in the fields)					
vi. Animal disease					
vii. Serious pest damage to crops					
viii. Market shock (e.g. collapse in prices)					
ix. Any others (please specify)_____					

Code Box for 1404

Response to Shock	**Code**	**Response to Shock**	**Code**	**Response to Shock**	**Code**	**Response to Shock**	**Code**
Did Nothing	1	Sold livestock (cows, buffalos)	5	Borrowed money from relatives/others	9	Reduction in education level of the children	13
Left land fallow	2	Provided supplemental irrigation	6	Drew down savings	10	Out migration to cities	14
Sold part of land	3	Changed cropping pattern	7	Reduced food consumption	11	Use of pesticides	15
Leased out part of land	4	Followed improved crop production practices	8	Shifted to non-farm employment	12	Any other, namely:	16

SECTION 15: COPING (ADAPTATION) STRATEGIES

1501. Did you receive any sort of assistance?

Yes.....1 (>>1502)
No.....2 (>>SECTION 16)

1502.If yes, who provided the assistance?

Organization/ Person	Assistance Provided (such as cash (amount), food, advice, etc.)
a. Government/district	
b. Relief agency / NGO	
c. Community/Social group	
d. Landlord	
e. Extended family	
f. Others (specify)	

SECTION 16:HOUSEHOLD DIET DIVERSITY DATA (HDDS)

Now I would like to ask you about the types of foods that you or anyone else in your household ate **yesterday during the day and at night at home**.

S. No.	Food group	1601. Please tick	1602. Source of item (tick which apply)			
			i. Own production	ii. Purchased	iii. Exchanged for labour	iv. Other (specify) _____
16a.	Rice, wheat, or maize					
16b.	Potatoes					
16c.	Vegetables					
16d.	Fruit					
16e.	Meat					
16f.	Eggs					
16g.	Fish or shellfish					
16h.	Foods made from beans, peas, lentils, or nuts					
16i.	Yogurt, milk or other milk products					
16j.	Fried food or food using butter, oil or ghee					
16k.	Sugar or honey					
16l.	Tea, coffee					

SECTION 17: REMITTANCE

1701 Type of work by migrant worker	1702 Daily wage/ salary (specify unit)	1703 For seasonal migrant		1704 In whose name is the remittance generally sent in? (Note person code)	1705 Who generally manages the cash remittances? (Note person code)	1706 Does [name of person who administers the remittances] alone decide how to spend the money? Yes.....1 No.....2	1707 How were remittances to this household spent during the <u>last year</u>? [CIRCLE ALL THAT APPLY]	1708 During the <u>last year</u>, what gifts have been sent? [CIRCLE ALL THAT APPLY]	1709 Who in the household received these gifts? (Note person code)
		No of months	No of days per month						
							Consumption expenses.....1 Housing expenses.....2 Health expenses.....3 Children's education.....4 Pay off debt.....5 Buy land.....6 Buy or build a house.....7 Buy or expand a business.....8 Buy agricultural land.....9 Buy agricultural tools and/or equipment.....10 Buy livestock.....11 Buy a consumer durable.....12 Savings.....13 Buy agricultural inputs.....14 Other.....15	Clothing/shoes.....1 Cell phone.....2 Electronics.....3 Computer.....4 Consumer durables.....5 S/he hasn't sent anything.....6 Others (specify).....7	

SECTION 18: Water Conservation awareness and actual practice

1801. Have you heard about the following practices? **Practice**	Yes….1 No…..2	1802. If yes, then from whom?	1803. If yes, do you follow it and how often? Never.....1 Sometimes....2 Always.....3
a. Reduced or zero tillage			
b. SRI			
c. Mulching			
d. Drip irrigation			

Thank you for your time. We appreciate all your replies. Do you have any general comments about this study and the questionnaire? Have we missed anything important in this survey that would help us better understand your work?

_____

_____

INTERVIEWER: Please record any interesting anecdotal information you may have received during this interview below

_____

_____

SECTION 19: Only for Enumerators

1. Was the person who answered the questions irritated or nervous during the interview?
   Yes.....1
   No.....2

2. How would you rate the overall quality of the interview?
   Good.....1
   Fair.....2
   Poor.....3

3. How many people were listening when you conducted this interview with the respondent?
   a. Other family members: _____
   b. Non-family members: _____
   c. None

---THE END---

Improving Water Use for Dry Season Agriculture by Marginal and Tenant Farmers in the Eastern Gangetic Plains

TECHNICAL NOTE

Decision Support Tools and Mobile Apps

Activity 3.4 in the DSI4MTF project involves the development of interactive tools to support the understanding and knowledge of improved irrigation, water and energy management. Some prototype software tools have also been developed to assist the project staff to capture field data. This Technical Note details some of the tools, their function, intended audience and potential improvements.

Decision support tools

Mobile phones, particularly internet connected smartphones are efficient tools for sending and receiving information in the field. Simple interfaces can capture data, process it and/or instantaneously send it to cloud databases for processing and storage. Using these tools can reduce the time delay for data transfer (from the field to the office) and any potential transcription errors.

Inputs and outputs

Some of the tools (e.g. Water Level Tool) have been designed for the one way transfer of data, and are aimed at the DSI4MTF field staff to collect and send data. Other tools are quick calculators (e.g. Conversion Calculator, Orifice Discharge Tool, etc.) that will give fast feedback to a query, but don't store any data. The remaining tools are a combination of both data capture and information feedback tools. These tools are capturing information and performing calculations but are also sending the data to a cloud database to build a time series dataset. These tools allow the analysis of trends but also help users make some estimate of what can be expected in the future.

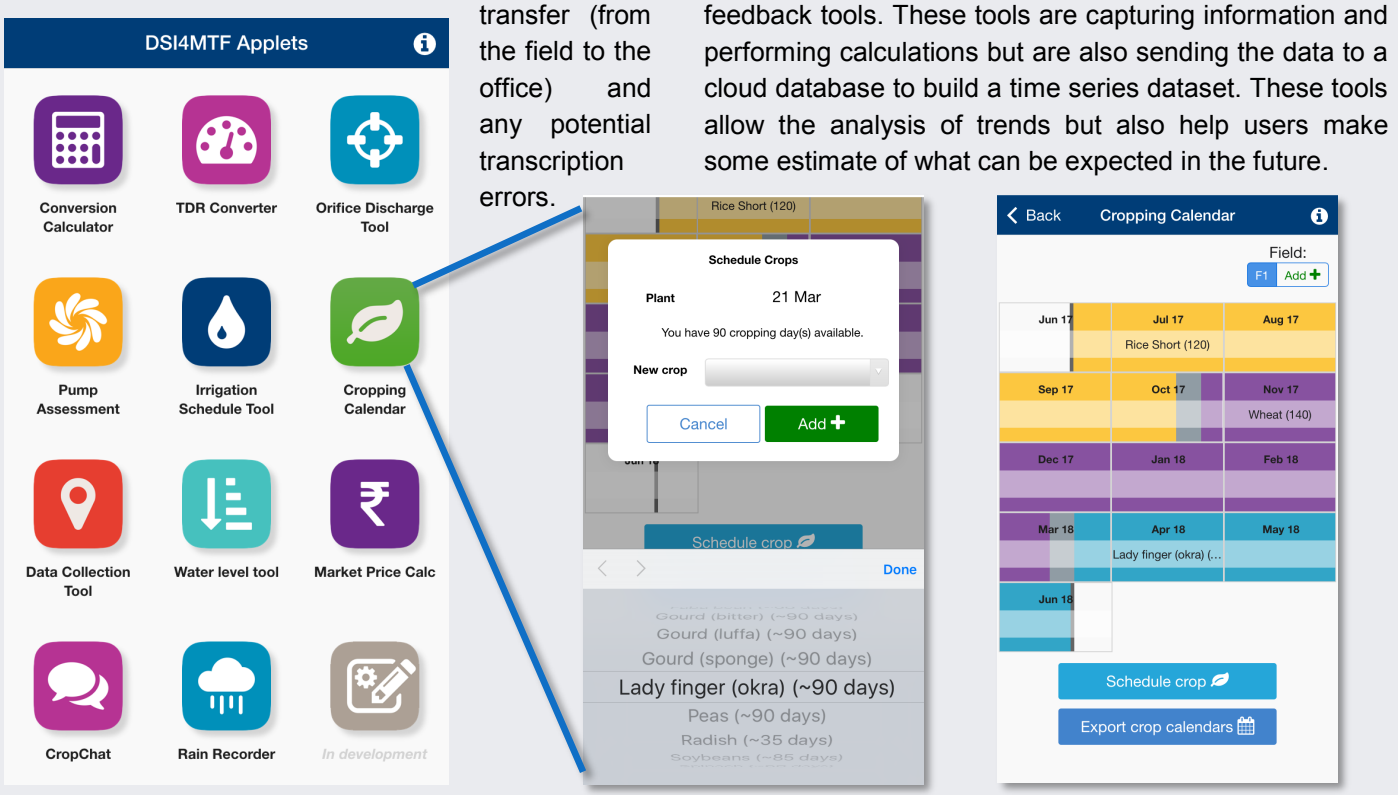

Figure 1:The DSI4MTF Applets portal contains a growing number of prototype apps. An example of an applet (above) is the Cropping Calendar, which allows farmers to investigate potential cropping rotations based on the planting of paddy and the remaining cropping days in a given year

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CSIRO
IWMI International Water Management Institute
ACIAR Research that works for developing countries and Australia aciar.gov.au

TECHNICAL NOTE

Decision Support Tools and Mobile Apps

Icon	Tool	Function	Audience	Inputs	Outputs	Potential
	Conversion Calculator	Converts units of area, weight and currency from SI/ Australian/US units to local measurements and currencies	Primarily those working in projects that cross state or country borders	Ha, or m^2, or Bihari Bigha, or Nepali Katta, or AUD	Other units i.e. West Bengali Bigha or INR, or BDT	Could also be expanded to rates i.e. convert quintals /katta to tonnes /hat
	TDR Converter	Converts the millivolt reading from a MP406 probe into volumetric soil moisture	DSI4MTF technical staff	Calibration curve	Point readings of volumetric soil moisture	Logging ability connected to phones GPS
	Orifice Discharge Tool	Calculated the flow rate from a pump using a velocity head and the orifice equation	DSI4MTF and SRFSI technical staff	Pump outlet diameter and the discharge velocity head	Flow rate in L/s and a graphic of the flow rate curve	
	Pump Assessment Tool	Calculates the cost of pumping (Rupees per kL). Captures assessment data and compare one scenario with another	DSI4MTF and SRFSI technical staff	Pump discharge and diesel usage	Cost of pumping at a point in time	Incorporate suction and discharge pressures and calculate % efficiency
	Irrigation Schedule Tool	Uses FAO56 methodology to calculate an irrigation schedule. Also records rainfall and irrigation applied	Initially DSI Team—eventually farmers with smartphones	Crop setup (soil, plant dates, etc) irrigation & rainfall data	How much irrigation to apply and when	Automatically capture rainfall and evapotranspiration data from a weather station
	Cropping Calendar	Scenario based assessment to determine the potential cropping rotations in a given year	DSI4MTF and SRFSI technical staff and farmers with smartphone	Paddy plant date, then choice of rabi and pre-khariff crops	Calendar of potential cropping rotations	Filter cropping options based on season Exporting of scenario reports
	Data Collection Tool	GIS data collection of fields and monitoring locations (ponds, tubewells) for real time relay to cloud database	DSI4MTF Team	Field polygons & pins, daily and weekly monitoring data	Field and infrastructure maps. GIS data	Improve the user interface and further simplify
	Water Level Tool	Simple tool for capturing real time pond and tubewell levels and water quality data	DSI4MTF Team	Weekly water level measurements	Auto uploads to the GIS data tables	Link to GPS to identify ponds and shallow tubewelsls
	Market Price Calculator	Allows users to collect data and watch produce market prices at the nearest 4 markets	DSI4MTF and SRFSI technical staff and farmers with smartphone	Regular prices of commodities at local markets	Best price for individual commodity, best market overall	Ability to compare seasonal and annual trends in market prices with climatic conditions
	Rainfall Recorder	Simple tool for the collection of site specific rainfall	DSI4MTF and SRFSI technical staff and farmers with smartphone	Daily rain gauge readings in mm	Rainfall chart and tracking against long term average	Link to display some forecasting
	Crop Chat	Forum for discussing agronomy and irrigation technical problems between the field and the advisors	DSI4MTF and SRFSI technical staff and farmers with smartphone	Questions on and photos of crop problems or irrigation hardware	Open, searchable discussions and answers	Categorisation of forum posts Alerts and notifications

Typical applications for the use of DSI Tools.

Conversion Calculator

Questions: How many square meters in one Nepali Bigha of land or one Bihari Bigha of land? How many mon are there in a quintal in West Bengal? How long will I need to pump for to apply 80mm on 1 acre at 6 litres per second?

The Conversion Calculator is a simple tool for converting a range of units including; area, weight, depth, length and currency.

The intended audience is primarily those working in projects that cross state or country borders that want compatible or comparable units

TDR Converter

Question: What is the soil moisture at the surface and at 20cm below the surface?

The project team adapted an MP406 soil moisture sensor to remove the need for an expensive logger or display unit. The sensor was essentially wired to 9V batteries and a small digital multimeter for a total cost of $9AUD. The TDR Converter tool simply used the factory standard sensor calibration to convert mV output from the sensor into a % volumetric soil moisture. The tool was used to understand the starting moisture condition for use in irrigation scheduling (refer section 7.4.5) but was also a useful demonstration tool. At all sites the project team engaged local farmers to use the hardware and mobile phone app together to demystify of the technology.

Orifice Discharge Tool

Question: What is the flowrate from that discharging pump?

This tool was designed to work in conjunction with a field hardware to convert the velocity head of water coming out of a pump into a flow rate using a hard coded equation. Ideally this would have been a fast method for assessing flow rate from a discharging pump, however the performance of the device was too erratic to be useful.

Pump Assessment tool

Questions: How much is that pump costing? What is the most efficient speed to run the pump?

This calculator was built to remove some of the complication of calculating the flowrate from a series of bucket and stopwatch tests, then dividing by the diesel burn rate calculated from the time taken to deplete a known volume of diesel. The tool generates a volume per litre of diesel used and if the user enters a price per litre of diesel it will return the cost of irrigation. This tool does not record any information to database and only operates as a calculator.

DSI scheduler

Questions: How much irrigation should I apply? When should I irrigate? What is my crop water productivity?

The tool uses the industry standard Food and Agriculture Organisation methodology (FAO56) for calculating soil moisture balance. Using FAO56, the tool undertakes a daily time step calculation incorporating evapotranspiration and local rainfall and irrigation data. The tool can provide a schedule of how much water to apply and when, to ensure that the crop is never water stressed. It can also output a seasonal tally of the in season rainfall and irrigation applied to each field. It compares this with the calculated crop water requirement and a user defined target of volume. At the end of each season the user can choose to enter some yield figures and the app will provide a number of metrics for comparing one field against another, or one season against another

Cropping calendar

Questions: Which crops will fit in my rotations? How long do I need for a radish crop? Can I grow conventional rice and wheat and still take a summer crop?

The cropping calendar allows users to visualise what rotations are available to them across 5 fields each year. It is a tool to experiment with to see what is possible. The year always begins with the planting of Khariff rice and then calculates the number of days left available until the next rice crop need to be planted. The options are filtered for example if there are only 50 days left in the cropping season then the crop options are limited only to short duration crops that can be harvested in less than 50 days. Users have control and can edit the default 'days' require to grow crops if they have better information or new varieties.

DSI Data collection

Questions: Where are the project sites? Which ponds and tubewells are being monitored? Who is the owner of this tubewell?

This tool was first designed to capture data on landlord and tenant names for a range of fields in attempt to identify large contiguous areas of land that could be leased from a single landlord. From here it developed into the project database for all geographic information. It is currently the tool for adding and removing monitoring sites, maping fields, ponds, tubewells, adding in new raingauges, etc. it is only intended to be used by the project team but has significant utility as a mobile device driven GIS tool.

Water Level tool

Questions: what is the depth to groundwater in that shallow tube well or pond?

This is primarily a data collection tool. Initially the utility of weekly data collection was within the DSI data collection tool. However, with such intense data collection it was easier to create a separate tool for regular and routine data collection. This tool has a very simple user interface including date picker, site selection dropdown and digit data entry field. The user then clicks 'save and the data is sent directly to a cloud based server and saved. If the user does not have 3G data connection at the time they click save, the data is stored on the mobile device and automatically synchronises with the server the next time they have connection.

Market Price Calculator

Questions: where is the best market to sell my cabbage? Where is the best maket to buy all my groceries? What is the advantage of getting my capsicume to the market 2 weeks earlier than everyone else?

This tool is currently being used by field staff but would ideally be used by farmers in the future. It is a repository of prices for a large range of commodities at three local markets nearby to each of the intervention villages. Each fortnight market price is collected for the products that are seasonally available in a very simple user interface. This is stored on cloud server and is easy to interrogate to show the historic prices for any given commodity. It is especially useful for farmers that have just harvested a crop and wanting to know where is the best market to sell. The app (informed by data that is essentially crowdsourced) shows the market with the best and worst price for the crop of interest. It shows the best mark for an individual crop and the best market for all commodities (useful when buying). The tool also allows the user to look at the time series of prices to show when the price is at a peak and when it is in a trough. A short video has been made to demonstrate the use of the app.

Rainfall recorder

How much rainfall have we had this year? How does that compare with the best, worst and average year?

This tool is similar to the water level recorder tool in that it is essentially a data capture tool but also allows for some feedback of information against long term average rainfall data for

the site. The tool allows the user to select a rain gauge and enter a daily total. It then plots this data as a yearly cumulative total in conjunction with the long term average data (synthetic) to show how the season is progressing in within the bounds of the highest, lowest and average rainfall. This tool could be enhanced to feed into the DSI Scheduler in future.

Crop Chat

What is this insect? Why is my wheat browning in patches? Which pesticide should I use and at what rate?

This tool was developed to assist 2-way communication between field staff (and eventually farmers) and researchers or scientists. The intention is that a field officer, scout, or farmer identifies a potential problem and posts the query to the Crop Chat board. It is an open forum that others can see and advise if they feel they have the expertise. This is similar to a WhatsApp group, with the exception that it is an open platform, which does not require an invitation from and administrator. It acts as a chatroom for farmers.

Table : Current function and potential of the DSI Apps suite of tools

Tool	Function	Potential
Conversion Calculator	Converts units of area, weight and currency from SI/ Australian/US units to local measurements and currencies	Expand to rates i.e. convert quintals /katta to tonnes /ha
TDR Converter	Converts the millivolt reading from a MP406 probe into volumetric soil moisture	Logging ability connected to phones GPS
Orifice Discharge Tool	Calculated the flow rate from a pump using a velocity head and the orifice equation	
Pump Assessment Tool	Calculates the cost of pumping (Rupees per kL). Captures assessment data and compare one scenario with another	Incorporate suction and discharge pressures and calculate % efficiency converted for electric pumping
DSI Scheduler	Uses FAO56 methodology to calculate an irrigation schedule. Also records rainfall and irrigation applied	Automatically capture rainfall and evapotranspiration data from a weather station
Cropping Calendar	Scenario based assessment to determine the potential cropping rotations in a given year	Filter cropping options based on season Exporting of scenario reports
DSI Data Collection Tool	GIS data collection of fields and monitoring locations (ponds, tubewells) for real time relay to cloud database	Improve the user interface and further simplify
Water Level Tool	Simple tool for capturing real time pond and tubewell levels and water quality data	Link to GPS to identify ponds and shallow tubewelsls
Market Price Calculator	Allows users to collect data and watch produce market prices at the nearest 4 markets	Ability to compare seasonal and annual trends in market prices with climatic conditions
Rainfall Recorder	Simple tool for the collection of site specific rainfall	Link to display some forecasting
Crop Chat	Forum for discussing agronomy and irrigation technical problems between the field and the advisors	Categorisation of forum posts Alerts and notifications

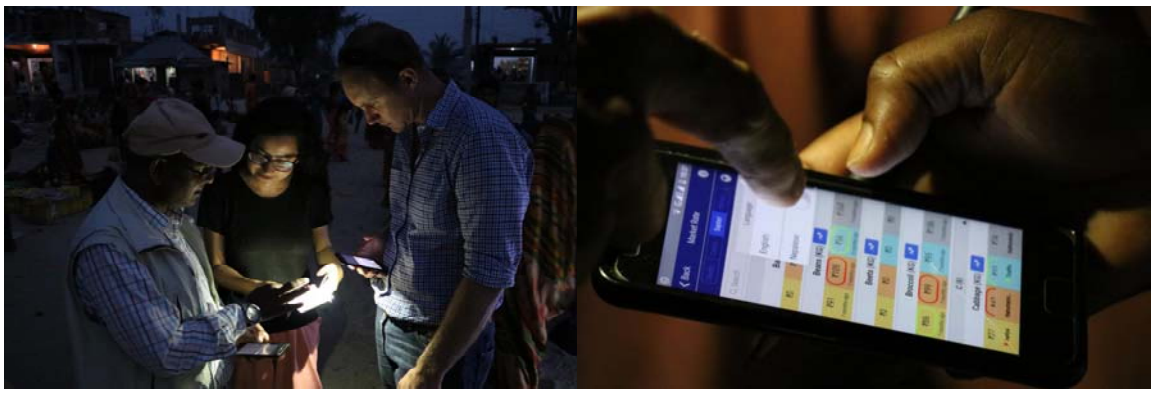
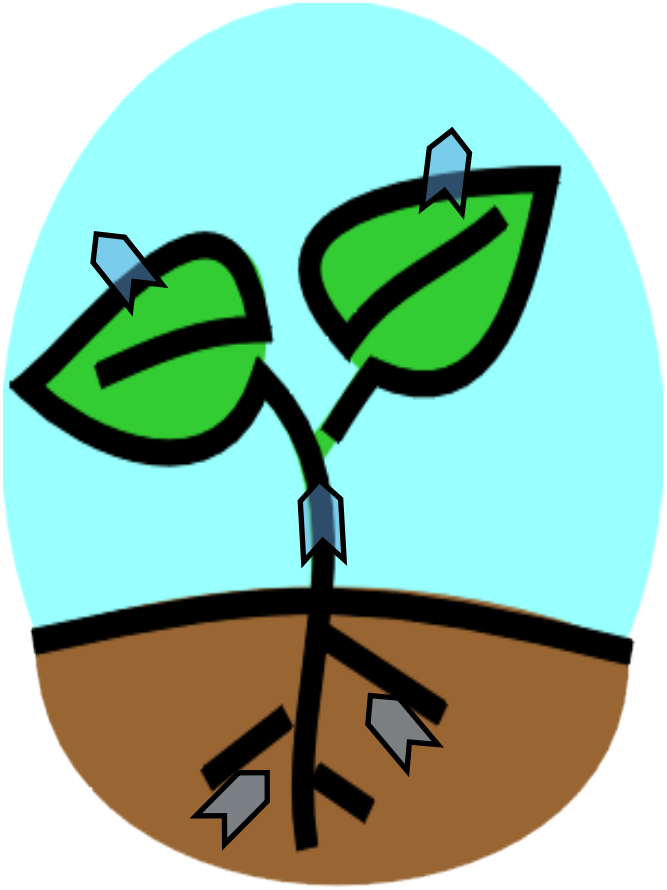


Photo : Using Market Rate App to collect commodity price in the market

DSI Irrigation Scheduling Plan

The Soil Plant Atmosphere Continuum is the term used to describe the connected pathway that water moves from the soil through the plant roots and stems, and exists to the atmosphere via the leaves (transpiration).

To manage irrigation to match the plant water requirements we need to know the rate that this transpiration is occurring. To do this we can measure or calculate the movement of water at any of the three stages of the continuum (soil, plant or atmosphere) or better still we can take measurements at all three stages and combine them for an even better result.



Selection of Methods

Method	Hardware	Software	Data output	Frequency	Locations	Time required	Detail and cost estimate
Atmosphere							
Water Balance (FAO56)	Rain gauge	DSI Scheduler Spreadsheet	Volume to apply and timing, record of irrigations applied	After every rainfall and irrigation	All fields	1 hr to set up 20 minutes each week	FAO56 Can be fine tuned with soil moisture data and MiniPan ($5)
Mini Pan	Open top container Ruler Measuring	Spreadsheet	Pan Evaporation (would need to be adjusted for ET)	Every week	One in each village	20 mins to set up 10 mins each week	Good visual guide to evaporation ($10)
Plant							
Visual assessment	Notepad Map	nil	Rough indication of plant stress	Daily	Each intervention site	10 mins each day	Feedback is too late. When the plant is showing stress, it is already reducing production ($2)
Soil							
Soil moisture monitoring probe	(TDR probe MP406 or Theta probe) Map	Spreadsheet	mV to convert to a volumetric soil moisture measurement	Every week	At 2 depths x 2 locations per intervention site	30 mins each week	Probe should be calibrated Using the volumetric method ($500 —$1000)
Volumetric soil moisture monitoring	Hand tools Sampling bags Map	Spreadsheet	% volumetric soil moisture at a point in time	Once per season	At 3 depths x 3 locations per intervention site	One day per season	Very time consuming Laboratory costs will vary ($2—$10 per sample)
Hand feel	Hand tools Notepad Map	nil	Rough indication of soil moisture	Every week	At 2 depths x 2 locations per intervention site	10 mins each week	Unreliable as it is subjective. Should be undertaken in conjunction with other moisture monitoring

Selection of Methods

	Pre-planting		Planting	Week 1, Week 2 , Week ...	Harvest/ Post harvest
Atmosphere					
Water Balance (FAO56)	Set up crops in the DSI scheduler tool. Make an estimate of the total irrigation to be applied through the season	Make adjustments to the settings in the DSI scheduler based on field measurements	Adjust the longt term average ETo data based on the mini pan	Enter daily /weekly irrigation applied Enter daily /weekly rainfall applied	Enter yield information and compare water use efficiencies
Mini Pan	Position the mini pan on a level surface in the field and fill it with water		Measure the change in water level in the mini pan and how much water is added to refill it	Measure the change in water level in the mini pan and how much water is added to refill it	Measure the change in water level in the mini pan and how much water is added to refill it
Plant					
Visual assessment	Inspect each field and make note of any agronomic or other technical issues.		Inspect each field and make note of any agronomic or other technical issues.	Inspect each field and make note of any agronomic or other technical issues.	Inspect each field and make note of any agronomic or other technical issues.
Soil					
Soil moisture monitoring probe	Use the TDR probe to take surface and subsurface readings at 2 depths and 2 locations per intervention site.	Record the TDR measurement and compare with the starting soil moisture in the DSI Scheduler		Take TDR readings in the same locations as pre planting. Compare with DSI Scheduler	Take TDR readings in the same locations as pre planting. Compare with DSI Scheduler
Volumetric soil moisture monitoring	Collect soil samples for lab assessment at 3 location and 3 depths per intervention site	Check the soil moisture is close to the DSI Scheduler—if not adjust and/or calibrate the hardware and the software			Collect post harvest samples at same location as pre plant this will then become the next seasons pre plant data
Hand feel	Hand feel to develop an appreciate the look and feel at different moisture contents			Hand feel to develop an appreciation of the look and feel at different moisture contents	

Compare measured data with modelled data

Compare measured data with modelled data

Compare measured data with modelled data

Improving Water Use for Dry Season Agriculture by Marginal and Tenant Farmers in the Eastern Gangetic Plains

TECHNICAL NOTE

DSI Scheduler for Irrigation Scheduling

Activity 3.4 in the DSI4MTF project involves the development of interactive tools to support the understanding and knowledge of improved irrigation, water and energy management. Some prototype software tools have also been developed to assist the project staff to capture field data. This Technical Note details the DSI Scheduler tool that can be used for irrigation scheduling and water management record keeping

Irrigation Scheduling

Plants transpire water from the soil through their roots, stems and leave out to the atmosphere. The rate that this transpiration occurs depends on a number relationships but is driven by the atmospheric demand.

To ensure optimum crop yields it is important to ensure that the plant has enough water (but not too much) to keep up with the atmospheric demand. Irrigation Scheduling ensures that the plant is getting not only the right amount of water but also that it is receiving it at the right time.

Figure 1:Over irrigation of crops is an expensive mistake. Firstly, paying for unnecessary pumping ,but also reducing potential yield due to water logging

DSI Scheduler

The DSI4MTF team have develop a mobile phone software program that calculates the crop water requirement and reports how much water to irrigate on each plot to ensure that the crop does not get water stressed. The DSI Scheduler tool uses the FAO56 Methodology for calculating the crop water use based on the Reference Evapotranspiration (ET_o) and crop specific Crop Coefficients (K_c). This crop water use can then be used in a daily soil water balance model to show how much water is left in the soil profile and when it needs to be irrigated again.

The tool can also be used to store irrigation and rainfall records and at the end of the season, calculate the water productivity .

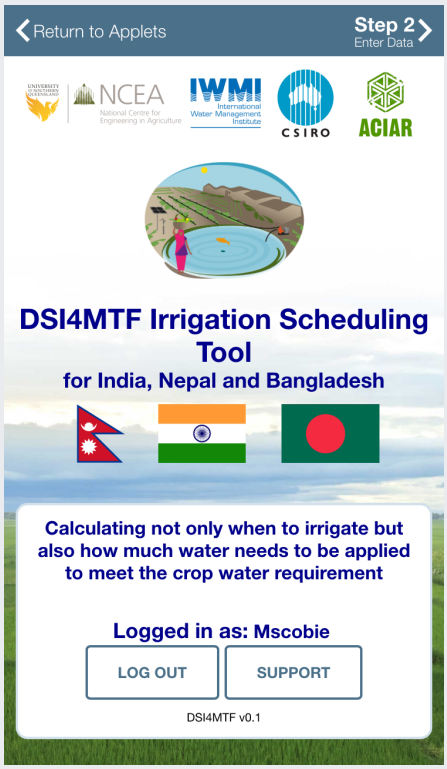


Figure 2 :The DSI Irrigation Scheduler is an FAO56 based decision support and data recording tool

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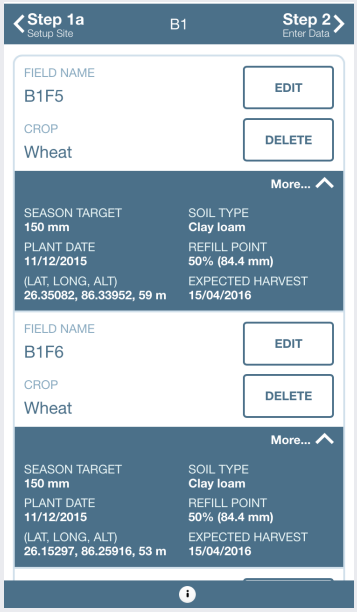
IWMI International Water Management Institute
ACIAR Research that works for developing countries and Australia aciar.gov.au

TECHNICAL NOTE

DSI Scheduler for Irrigation Scheduling

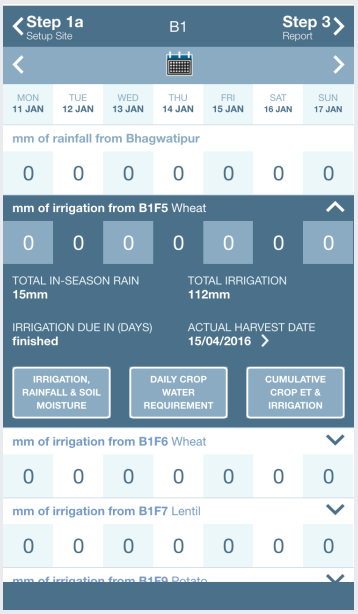
Step 1 – Set up fields and crops

The user sets up the tool at the beginning of each season for each crop or plot. This is a simple process and only requires a field name, crop type, soil type and plant and expected harvest date with an estimate of how much irrigation is to be applied. The app calculates the amount of plant available water based simply on the soil texture chosen and holds the long-term average evapotranspiration data for each intervention site which can be overwritten as necessary.

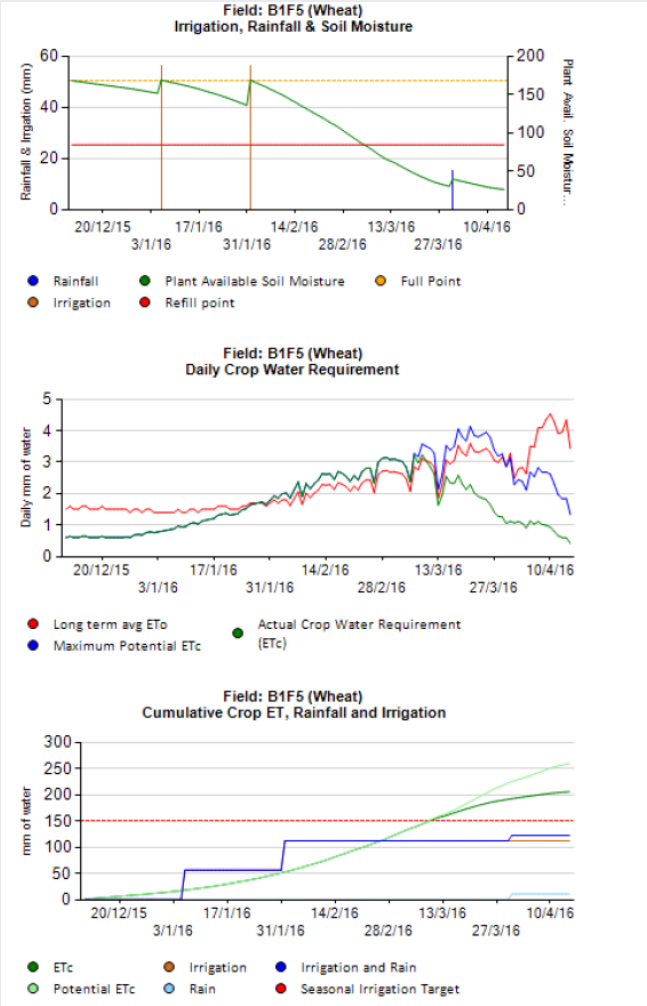


Step 2 – Enter Rain and Irrigation

Once the tool is set up, the DSI Scheduler displays data just like a calendar, and lets the user enter the rainfall and irrigation (mm) that have been applied on each plot It can quickly show how much in-season rainfall the crop receives and how much irrigation has been applied to each plot. From here the user can see when the next irrigation is due on a particular field. The quickl buttons will give a graphical representation of the data that has been collected and the calculation that have been used to generate the irrigation schedule



Step 3 – Producing Reports



The DSI Scheduler can then be used to output some reports for analysis (Detailed Report) or Action (Scheduling report)

The **Scheduling Report** is a simple output that shows the user which field need irrigating and how much to apply to each field to refill the soil profile to field capacity. The **Detailed Report** can be used at any stage of the growing season to see how the crops are performing from a water use perspective.

The detailed report provides a summary table and three graph for each field that is selected and can be exported to a PDF document for easy sharing.

Daily Irrigation , Rainfall and Soil Moisture

The first graph shows the calculated soil moisture through to present day (or harvest date). The green trace falls every day that the crop is using water and rises sharply whenever there is a rainfall or irrigation event.

Daily Crop Water Requirement

The second graph simply displays the daily crop water use through the season. This graph can show when the crop is water stressed and is not transpiration at the optimum rate.

Cumulative Crop ET, Rainfall and Irrigation

The third graph shows the seasonal cumulative totals of crop water use against rainfall and irrigation applied. This lets the user track if water is being applied at the right time to meet crop demand.

At the end of the season, the Detailed Report can be used to compare the performance and yield of fields and farms against each other or a singe field over multiple season through time.

Appendix 10

Summary of Training Topics Covered in Regions

Saptari	
Nursery Raising Training	Soil solarisation technique
Compost Manure Making Training	Integrated Pest Management (IPM) Training
Seed Fertilizer Pesticide training	Agronomic training, crop selection, planting and weeding
Group Management Training	Group capacity and leadership training
Micro Irrigation Technology Training	Paddy seed treatment and nursery
Seed Fertilizer Pesticide training	Repair and maintenance of shallow tube well and sunflower pump
Record keeping Training	Market linkage, access to input, seeds and fertilizer
Soil Solarization Training	Post-harvest handling training
Gender Training	Irrigation Scheduling / Water management

Madhubani	
Nursery raising of vegetable crop	Group book of records management
Off season vegetable cultivation practices	Marketing linkages
Management of cucurbitaceous crop	Cooperative management
Drip and Sprinkler irrigation system	Group management & leadership
Pond excavation and use	Gender training
Ridge and furrow for irrigation,	Exposure visit to palandu Ranchi
Plant protection improve production	Cultivation practices of vegetable crops
Gender awareness	Fertilizer management in vegetables
Book keeping	Irrigation scheduling and on-farm water management practices
	Field exposure visit to Ranchi

Cooch Behar	
Training on collective farming concept	Market chain analysis
Record maintenance by the farmers	Cooperative farming
Collective farming and institution building.	Profit and loss distribution
Pump operation	Cropping calendar
Gender training	Assessment of existing resources - Participatory planning
Relay cropping of lentil	Conflict resolution
Plant protection measures in rapeseed-mustard,	Exposure visit - UC to Dhaloguri
Disease management in potato	Participatory gender training
Rice intensification in boro paddy cultivation,	Collective management
Improved jute production	Maintenance and management of bio-physical infrastructure
Practices for rapeseed-mustard	Strengthening the institution and up-scaling
Water management for summer vegetables	Nursery management in kharif paddy

Bangladesh	
Crop production	Alternative wetting and drying
irrigation scheduling	Pump operation
Field data collection	Improved cultivar selection
Discharge, infiltration water level measurement	Water management technologies

< Contents

Improving water use for dry season agriculture by marginal and tenant farmers in the Eastern Gangetic Plains

Site Information			
Village	Koiladi	Crop	
Plot ID	K1F02	Variety	
Plot Area (m2)	846	Planted Area (m2)	846
Sub Plot		Planting Date	
Farmer Name		Final Harvest Date	
Season	Khariff 17		

Performance	Unit	Quantity	Rate	Amount
Main product yield	kg			
Main product sold	kg			
By-product yield	kg			
By-product sold	kg			
Total Expenditure		0		
Total Revenue		0		
Gross Margin		**0**		

Season Activities			Agri-inputs (external inputs)				Labor use								Machinery use					
								Quantity				Rate (Per Day)							Amount - Activity total	Remarks
Activity	Sub-Activity	Date (01/05/17 to 01/12/17)	Unit	Quantity	Rate (Per Unit)	Amount	Unit	Hired Male	Hired Female	Own Male	Own Female	Female	Male	Amount	Unit	Quantity	Rate (Per Unit)	Amount		
1 - Seedbed preparation	Land preparation																			
1 - Seedbed preparation	Land preparation																			
1 - Seedbed preparation	Land preparation																			
1 - Seedbed preparation	Land preparation																			
1 - Seedbed preparation	Land preparation																			
1 - Seedbed preparation	Land preparation																			
2 - Seeding/planting	Own seed																			
2 - Seeding/planting	Purchased seed																			
2 - Seeding/planting	Borrowed seed																			
2 - Seeding/planting	Own seed																			
3 - Farmyard manure																				
4 - Other organic fertilizer																				
5 - Fertilizer application	Urea																			
5 - Fertilizer application	Urea																			
5 - Fertilizer application	Urea																			
5 - Fertilizer application	Urea																			
5 - Fertilizer application	DAP																			
5 - Fertilizer application	DAP																			
5 - Fertilizer application	DAP																			
5 - Fertilizer application	Potash																			
5 - Fertilizer application	Potash																			
5 - Fertilizer application	Potash																			
5 - Fertilizer application	Other chemical fertilizer																			
6 - Pesticide																				
6 - Pesticide																				
6 - Pesticide																				
7 - Weeding	Weeding																			
7 - Weeding	Weeding																			
7 - Weeding	Weeding																			
7 - Weeding	Weeding																			
7 - Weeding	Weeding																			
7 - Weeding	Herbicide																			
8 - Physical fencing																				
9 - Irrigation	Surface																			
9 - Irrigation	Surface																			
9 - Irrigation	Surface																			
9 - Irrigation	Surface																			
9 - Irrigation	Groundwater																			
9 - Irrigation	Groundwater																			
9 - Irrigation	Groundwater																			
9 - Irrigation	Pond																			
9 - Irrigation	Pond																			
9 - Irrigation	Pond																			
10 - Harvesting																				
10 - Harvesting																				
10 - Harvesting																				
10 - Harvesting																				
10 - Harvesting																				
10 - Harvesting																				
10 - Harvesting																				
11 - Threshing																				
11 - Threshing																				
11 - Threshing																				
12 - Product transportation																				
12 - Product transportation																				
12 - Product transportation																				
12 - Product transportation																				
13 - Storage																				
14 - Land rent																				
15 - Other activities																				
15 - Other activities																				
15 - Other activities																				

Appendix 12

Framework for periodic socio-economic and community engagement monitoring and data collection

Aside from the day to day collation of meeting and training minutes (Annex 1 and 2) seasonal socio-economic baseline report must be prepared (annex 3) which highlights both how farmers are responding to the interventions, positive stories and challenges faced, as well as critically engaging with the process of project implementation and community engagement.

Task	**Frequency**	**What to document**	**Reporting template**
Group meeting minutes documentation	Whenever there is a group meeting	Continue to take meeting minutes, and ask key questions as per the meeting template (see Annex 1). Under section 2 of the minutes ensure to document the following: • Any challenges which have occurred. Why? Who is involved? • Any positive stories which have occurred. Why? who is involved? • Any conflicts – how are/will they be resolved?	Annex 1
Training documentation	Whenever a training takes place	Report from the training • What worked well, why? • What didn't work well, why? • Any individual stories/experiences following the training?	Annex 2
Documentation of household or individual case studies	Seasonal (**3 times per year at least**), including case studies from **individuals** or ***households*** from **each intervention site**	Collect qualitative data on interventions and the social impact on beneficiary households for each season, using appreciative enquiry =. Data must be detailed and textured – quotations are valued (see Annex 4) This can be done through the following process (i) identify a set of households or individuals with interesting stories or experiences through discussion with local partners and field observation (ii) gather background info on these households from the socio-economic baseline survey, and generate a profile for each household (iii) visit households, and engage with them through informal unstructured interviews.	Annex 3

		The case study part of the report (Annex 3) should including the following: 1. Background of each hh/individual (e.g. migration status, land ownership, women or male headed etc) 2. 'Positive' stories: • Examples of perceived economic/livelihood benefits. Give clear and detailed information. • Examples of perceived benefits in terms of bargaining power with others (e.g. women/men; landlords/tenants; farmers/traders). Give clear and detailed information. 3. Negative stories • Examples of farmers who make a loss or perceived livelihood stress due to the project. • Examples of farmers who have felt that they have limited power within the group, or feel undermined at meetings 4. Lessons for the project	
Collective action case studies	Seasonal (3 times per year at least), at least one per village.	Collect qualitative data on interventions and the social impact on beneficiary households for each season, using appreciative enquiry. The idea is to generate information on how the group is functioning, and highlight any problems and solutions. The collective action part of the report (Annex 3) should include • Examples of effective cooperation – e.g. division of tasks within the group • Examples of the group sacrificing individual interests for the benefit of the group • Examples of conflicts which have arisen as a result of labour management, cost sharing etc. how were they resolved? • Examples of conflict resolution within the group	Annex 3

Documentation of technology case studies	Seasonal (3 times per year at least)	Collect qualitative data on technologies. This can be done through the following process (i) identify a set of stories relating to different technical interventions being piloted (ii) visit households, and engage with them through informal unstructured interviews. The collective action part of the report (Annex 3) should include: 1. What went well, and why? 2. Which technologies have faced problems. Why? Were challenges technical or social? 3. Lessons for the project	Annex 3
Documenting engagement	Seasonal (3 times per year at least)	In note form, the following information should be collected on a seasonal basis to reflect on the previous season of work. The collective action part of the report (Annex 3) should include the following: 1. **Institutional Strengthening Development:** What has been done to strengthen the cohesion of the collectives, and increase their links with other institutions such as farmer clubs or groups? 2. **Consolidating interventions:** Several interventions have been laid in the field including bio-physical and social. We need to identify the following: • Physical progress –what has happened in the last season and what not as per the plan? Why? • Required support –how long it has been pending and why 3. **Consolidating participatory approaches**: Participatory approaches are not needed	Annex 3

		for social sectors but also in bio-physical and technology. The first requirement, therefore, is to consider the farmers as partners in the research and other knowledge production endeavours. While planning a training schedule/cropping pattern/seasonal technology intervention how have farmers' views must be solicited and reflected? 4. **Spreading and consolidating leadership base:** During the period several new leaders have emerged. This is a happy sign but this also creates threat perception among the established leaders. This may lead to conflict. There is a need to carefully build emerging leadership in an environment where the established leaders in the community or group feel like nurturing and promoting new set of leaders. It is useful to document the following: • *Have we identified people with leadership traits –taking responsibilities /showing accountability* • *Have they been allocated more tasks and mentoring to accomplish them.* • *Have they received encouragement* • *Have they had opportunities for exposure to other innovative locations (e.g. neigbouring village intervention sites)* • *Have they received training for simple skills like writing minutes/applications/reports /documentations.*	

		5. **Enhancing and consolidating stakeholder's network:** Stakeholders consultations are not only to inform them but to keep them on board during the implementation period expanding the outreach of the learning. The stakeholders, however, would not run to the project by themselves. Some concrete activities are needed which may include the following: • Have they been invited for events such as technology demonstrations, meetings? • Have we done any public outreach work e.g. signboards, printing news briefs etc? **6. Engaging farmers in data collection** Farmers will adopt social and biophysical interventions if they are involved in collecting data and information supporting local capacity development and learning. • How are farmers assisting in data collection? • How is it helping them develop capacity and improving their understanding? • How is information being packaged to feedback to them key findings and lessons?	

ANNEX 1 – farmer group meeting minute template

1. GROUP DETAILS

Group No 1
Group Name: No name yet
Date 24.11.15
Length 1.5hr
Number of participating members: 9:
Number of women 4

2. KEY ISSUES DISCUSSED GIVEN

Purpose of Meeting (information/sensitization/training)

Key points discussed. Key issues noted.

- Any challenges which have occurred. Why? Who is involved?
- Any positive stories which have occurred. Why? who is involved?
- Any conflicts – how are/will they be resolved?

3. ISSUES WHICH REQUIRE ACTION

What must be followed up

Who must follow up

When

4. METHODS FOR MEETING

Method: Lecture ___% Discussion __% Interview___% Game____% Other:_____%

Material (cards, crops, handouts….)

How many participants stated their opinion?

What were the key points made by participants?

Which skills did the participants use or learn?

Knowledge/Skill	Rating					Explanation
Communication & Discussion	1 (no)	2	**3**	4	5 (a lot)	
Rule establishment	1	2	3	**4**	5	
Agricultural Knowledge	1	**2**	3	4	5	
Irrigation Knowledge	1	**2**	3	4	5	
Project Information	1	2	3	4	**5**	
Empathy/Group engagement	1	**2**	3	4	5	
Organizational skills	1	2	3	**4**	5	
Decision-making	1	2	**3**	4	5	
Gender Awareness	1	2	**3**	4	5	
Farmer involvement	1	2	**3**	4	5	

5. OBSERVATIONS – WHO WAS MOST OUTSPOKEN, WHO DIDN'T PARTICIPATE?

6. KEY DISCUSSION AND ACTION POINTS FOR NEXT MEETING

Annex 2: Template for reporting on training

1. Location of training

2. Who was present (farmer group and names of participants)

3. How was the training carried out (lecture, field tour, demo, combination)

4. Reflection on the training

- What worked well, why?
- What didn't work well, why?
- Any individual stories/experiences following the training?

Annex 3: Template for seasonal socio-economic and community engagement report

Household case studies

1. Background of each hh/individual (e.g. migration status, land ownership, women or male headed etc) included in the report.

2. 'Positive' stories:

- Examples of perceived economic/livelihood benefits. Give clear and detailed information.
- Examples of perceived benefits in terms of bargaining power with others (e.g. women/men; landlords/tenants; farmers/traders). Give clear and detailed information.

3. Negative stories

- Examples of farmers who make a loss or perceived livelihood stress due to the project.
- Examples of farmers who have felt that they have limited power within the group, or feel undermined at meetings

3. Lessons for the project

Collective action and functioning of the group

1. Background to each group which is included

2. Case studies

- Examples of effective cooperation – e.g. division of tasks within the group
- Examples of the group sacrificing individual interests for the benefit of the group
- Examples of conflicts which have arisen as a result of labour management, cost sharing etc. how were they resolved?
- Examples of conflict resolution within the group

Technology case studies

Which technologies are being reviewed.

1. For each technology report what went well, and why?

2. Which technologies have faced problems. Why? Were challenges technical or social?

3. Lessons for the project

Community engagement and project implementation reporting

What has the project team done in each of the below key fields of intervention:

7. **Institutional Strengthening Development:** What has been done to strengthen the cohesion of the collectives, and increase their links with other institutions such as farmer clubs or groups?
    a. Report on any trainings, referring to training meeting reports
    b. Any informal ways in which farmers have learned? E.g. case study of a farmer learning from another farmer. Case study of farmer seeking support from extension service.

8. **Consolidating interventions:** Several interventions have been laid in the field including bio-physical and social. We need to identify the following:

- Physical progress –what has happened in the last season and what not as per the plan? Why?
- Required support –how long it has been pending and why

9. **Consolidating participatory approaches**: While planning a training schedule/cropping pattern/seasonal technology intervention how have farmers' views been solicited and reflected?

10. **Spreading and consolidating leadership base:** There is a need to carefully build emerging leadership in an environment where the established leaders in the community or group feel like nurturing and promoting new set of leaders. It is useful to document the following:
    a. Have we identified people with leadership traits –taking responsibilities /showing accountability
    b. Have they been allocated more tasks and mentoring to accomplish them?
    c. Have they received encouragement
    d. Have they had opportunities for exposure to other innovative locations (e.g. neigbouring village intervention sites)?
    e. Have they received training for simple skills like writing minutes/applications/reports /documentations?

11. **Enhancing and consolidating stakeholder's network:** Some concrete activities are needed which may include the following:
    - Have stakeholders been invited for events such as technology demonstrations, meetings?
    - Have we done any public outreach work e.g. signboards, printing news briefs etc?
    - Have any new stakeholders built up links with farmers this season?

12. **Engaging farmers in data collection**
    Farmers will adopt social and biophysical interventions if they are involved in collecting data and information supporting local capacity development and learning.
    - How are farmers assisting in data collection?
    - How is it helping them develop capacity and improving their understanding?
    - How is information being packaged to feedback to them key findings and lessons?

Study Site Overview

Site selection was discussed took place over the period September 2014 to May 2015. Thirty-five sites were selected across 12 villages. Figure 1 shows the location of these villages. Sites comprised small intervention areas, where alternative approaches for irrigation and dry season cropping were demonstrated, and in the case of India and Nepal sites, alternative approaches to land tenure and their impacts on livelihoods and resilience were explored.

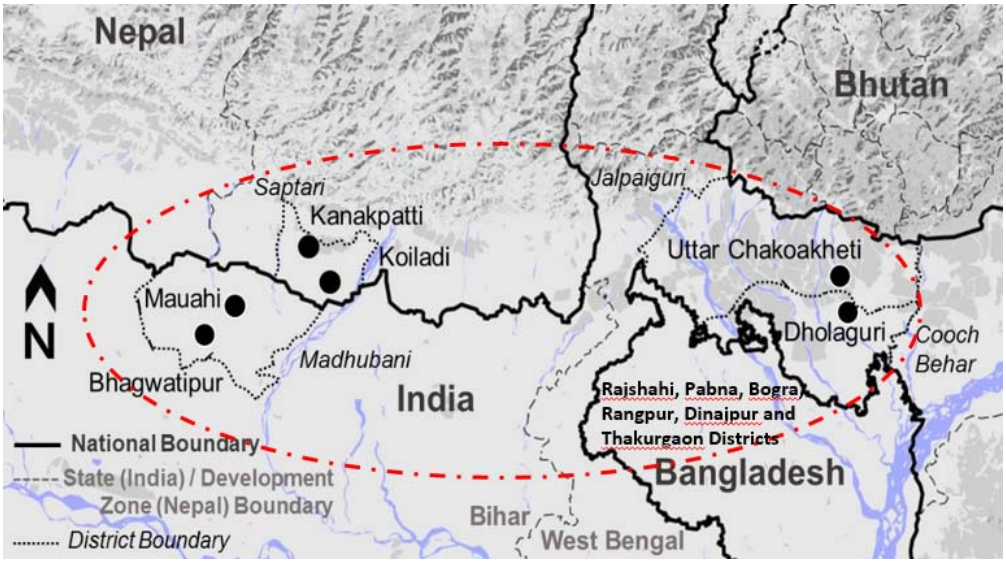


Figure 1a: Locality map of study regions

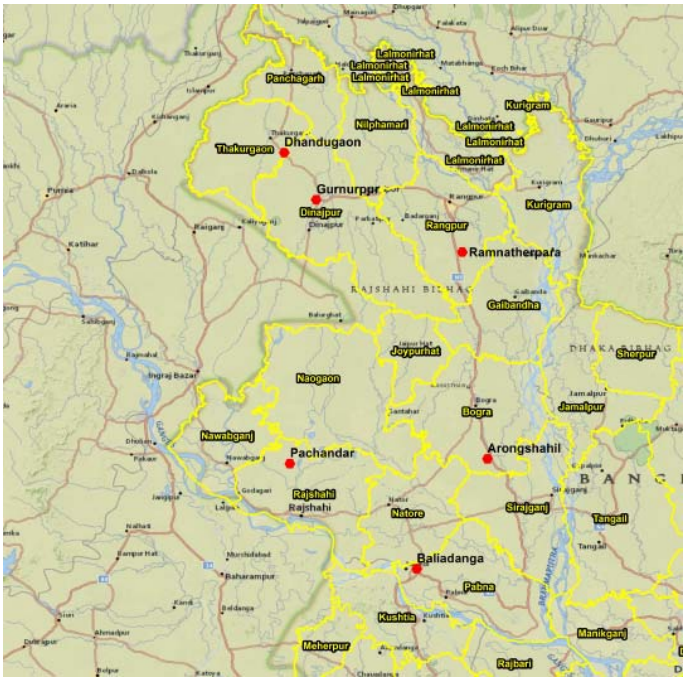


Figure 1b. Locality map of Bangladesh sites

India and Nepal Sites

The India and Nepal sites cover a diverse and complex area in terms of the patterns of agriculture and social structures, as detailed in a village characterisation and baseline report (Sugden et al 2016 Report No 1). There are however similarities, for example between the Nepal villages (Saptari) and the Bihar site (Madhubani). Both these regions are characterized by high levels of land inequality, dominance of a small class of landlords, and heavy concentration in the ownership of irrigation equipment. While these are drier areas compared to North Bengal, the aquifers of the region are rich, and shallow tubewell irrigation is widespread, with irrigation also available from ponds and to a lesser extent from canals. However, the level of irrigation is generally associated with one's economic status, and the deeply inequitable social structure grounded in class, class and gender relations has acted as a considerable constraint for the sustainable intensification of agriculture. While marginal and tenant farmers often do go ahead and invest in dry season irrigation as they seek to meet their minimum subsistence needs in the context of a changing climate, the costs and risks entailed are higher. In some cases this can lead to lower yields and cropping intensities, although most importantly the costs of renting tubewells, pump sets and other equipment add to the economic stress on already fragile livelihoods. This region thus had strong potential for interventions, which can encourage improved irrigation practices and group ownership of equipment, while also addressing land inequality and fragmentation through farmer collectives. The collective leasing model is therefore the preferred system of collectivisation for DSI4MTF.

In West Bengal by contrast, a very different series of challenges are present. This is a higher rainfall region, and rainfed dry season agriculture has more potential in villages such as Dholaguri and Uttar Chakoakheti. However, there is a limited big farmer class or even landlord class. Land reforms in the 1970s mean that most farmers have at least some land, and tenancy often occurs between farmers of a similar economic status as a way of managing land and labour deficits. The lack of a progressive large farmer class at all in villages such as Uttar Chakoakheti mean that there is very limited exposure to new irrigation systems, and even the use of pump sets is rare, with most farmers cultivating a single paddy crop. Even the water market for pumps is limited. In these villages, improving all around access to irrigation is a priority, particularly given that the groundwater is plentiful – not to mention the need to look into cropping patterns which can utilize the residual post monsoon soil water in this high rainfall region. The feasible model of collectivization is however very different, and for this reason DSI4MTF is experimenting with the voluntary consolidation of land amongst small holders, rather than collective leasing.

All sites have good access to groundwater resources with water table depth typically varying between 1-7m. While ponds occur, they offer limited storage and are usually used for fish production, due to higher economic returns, as well as for domestic and religious purposes. In some cases, there is limited supplementary irrigation from ponds during drought years. Groundwater and pond water quality in all the study areas is generally of good quality for irrigation in terms of pH and electrical conductivity; however, reports from other areas within the study districts suggest potential for occurrence of iron, fluoride and arsenic contamination.

Cropping patterns are traditionally based on a monsoon rice crop with some winter (Rabi) season cropping. There is much potential for a three-crop system with better access to irrigation water.

Table 1 summarises the area of each study site, farmer composition and biophysical interventions introduced. Figures below and Appendix 2 give locality maps.

Table 1: Summary of study site area, gender composition and biophysical interventions introduced. (India and Nepal Sites)

Region	Village	Site	Intervention Area (ha)	No farmers	% Woman	% Marginal	% Tenant	Dry Season Production introduced?	Groundwater access improved?	Pond Rehabilitation?	Conjunctive water use?	Improved irrigation systems?	Solar Pumping?	Improved land and water management?
Bihar	Bhagwatipur	Site 1	1.5	10	60	40	100	Y	N	Y	Y	Y	Y	Y
		Site 2	2.1	9	100	0	100	Y	N	N	N	Y	N	Y
		Site 3	1.3	8	60	40	70	Y	N	N	N	Y	N	Y
		Site 4	0.6	5	100	0	100	Y	N	Y	Y	Y	Y	Y
Bihar	Mauahi	Site 1	2.2	6	67	33	100	Y	Y	N	N	Y	N	Y
Total or Average			7.7	38	77	23	94							
Cooch Behar	Dholaguri	Site 1	1.1	8	25	50	50	Y	Y	N	N	Y	N	Y
		Site 2	1.3	11	45	45	38	Y	Y	Y	Y	Y	Y	Y
		Site 3	1	10	40	54	45	Y	Y	N	N	Y	N	Y
Cooch Behar	Uttar Chakowakl	Site 1	2.4	8	0	63	37	Y	Y	N	N	Y	N	Y
		Site 2	2.1	8	44	44	56	Y	Y	N	N	Y	N	Y
		Site 3	1.8	16	81	62	38	Y	Y	N	N	Y	Y	Y
		Site 4	0.9	8	20	100	0	Y	Y	N	Y	Y	N	Y
Total or Average			10.6	69	36	60	38							
Saptari	Kanakpatti	Site 1	1	8	100	100	100	Y	Y	Y	Y	Y	Y	Y
		Site 2	0.9	7	86	100	100	Y	Y	N	N	Y	Y	Y
		Site 3	0.4	8	37.5	100	100	Y	Y	N	N	Y	Y	Y
Saptari	Koiladi	Site 1	0.7	7	57	100	100	Y	Y	N	Y	Y	N	Y
		Site 2	1.2	7	43	100	100	Y	Y	N	N	Y	N	Y
Total or Average			4.2	37	65	100	100							

Saptari District

Saptari District lies in the Nepal Terai and is generally flat with an altitude variation between 60m and 610m. The climate is sub-tropical to tropical with average temperatures varying from 16^0C in winter to 29^0C in the summer, with an annual rainfall of between 1600 mm and 2100mm.

The aquifer underlying the district is variable along a north-south transect with relatively higher water tables to the south and lower water tables to the north. Despite the high precipitation and high water tables, drought is a common challenge as much of the precipitation falls within the monsoon period from June to September with the rest of the year generally dry.

The cropping pattern generally falls into two main seasons, Kharif (May to October) and Rabi (November to April). Apart from these two main seasons, a small number of farmers grow vegetables and other summer crops, between the main seasons, by either changing the planting/harvesting dates of the main crops and/or foregoing a season of the main crops.

Ponds are used for fish production or household use and not for irrigation, which is from groundwater. Water quality for irrigation is generally good, although monitoring of iron, as a precursor of more serious water quality minerals such as fluoride and arsenic needs consideration (Rajmohan et al 2017 Repot No 16).

A total of 21plots were monitored across the two sites at Koiladi and 56 plots across the three sites at Kanakpatti. Figure 3 summarises the percentage of plots cropped across seasons and shows the increase in cropping intensity through introduction of Rabi and Summer crops. Winter (Rabi) season crops introduced by the project included cabbage, cauliflower, garlic, onion, brinjal, tomato, potato, radish, corianda and lentil. Summer crops introduced included chilli, cucumber, bitter gourd, ladyfinger (okra), pumpkin, zucchini, cowpea, maize, and moongbean.

Koiladi Village

Koiladi Village is located at latitude 26.484^0N, longitude 86.809^0E. The underlying soil material is Gleysol (GLe) with a loam clay soil texture. The study identified 37 permanent ponds and 15 temporary ponds in the broader village, used mainly for fishing and domestic water supply. Irrigation from ponds is rare. Irrigation is primarily from shallow tubewells with depth to groundwater generally less than 5m. Two demonstration sites were established with a total of 21 plots covering 1.9ha. A number of tubewells and ponds were identified for water level monitoring (see site map Figure 4 and Appendix 2).

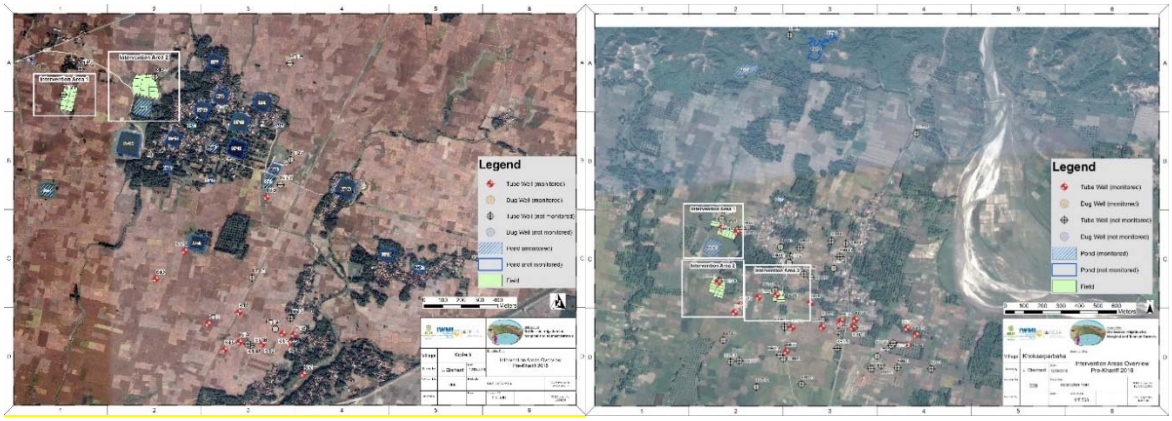


Figure 2: Koiladi and Kanakpatti study sites

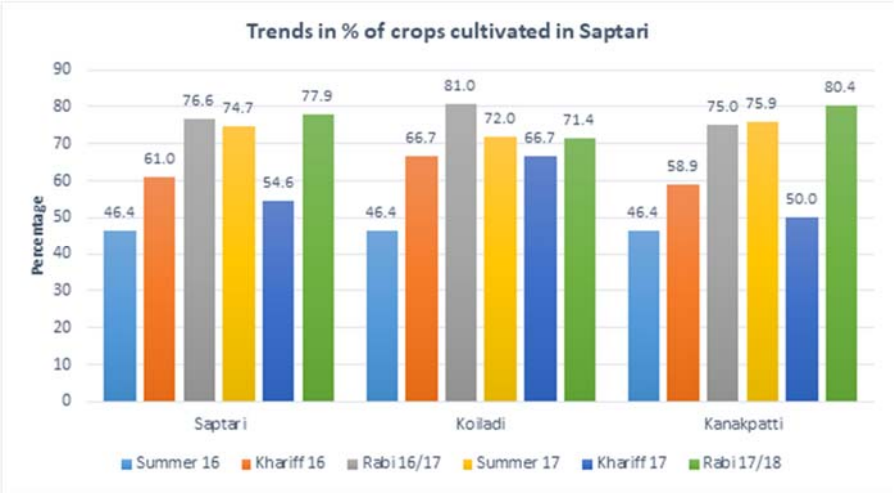


Figure 3: Seasonal trends in percentage of plots cultivated (Saptari combined, and Koiladi and Kanakpatti)

Kanakpatti Village

Kanakpatti Village is located at latitude 26.637^{0}N longitude 86.700^{0}E and has 10 permanent ponds and 11 temporary ponds, with surface areas ranging from 200sqm to 8000sqm. Most of the temporary ponds comprise areas flooded during the monsoon season.

Irrigation is mainly from tubewells with depth to groundwater varying between 1.5m-5m in September (post-monsoon) and 4m-7.5m in May (pre-monsoon). There is significant geological heterogeneity, and rapid fall in water table depth occurs during pumping with slow recovery in the water table, which affects irrigation capability and care is required when positioning tubewells. Three demonstration sites were established with a total area of 56plots covering 2.3ha.

West Bengal

The study sites of Dholaguri (Cooch Behar District) and Uttar Chakoakheti (Alipurduar District) are located in the State of West Bengal. These two study sites encompass both the pure Terai sites of Dholaguri to the south and the hill areas of Uttar Chakoakheti to the north.

These two villages, though different in topographical, cultural and social characteristics are agriculturally similar with Kharif paddy as the dominant crop grown. Due to the cultural agricultural background, Dholaguri has a more robust crop production system than Uttar Chakoakheti where the residents still consider forest product harvesting a major activity outside the monsoon growing seasons.

A total of 90 plots were monitored across the three sites at Dhaloguri and 139 plots across the four sites at Uttar Chakoakheti. Figure 5 summarises the percentage of plots cropped across seasons, and the increase in cropping intensity through introduction of especially Rabi season crops. Crops introduced included winter (Rabi crops) of rapeseed(mustard), wheat, maize, potato, tomato, cabbage, lentil, garlic and summer crops of jute, brinjal, gourd, cucumber and beans.

Figure 4: Dholaguri and Uttar Chakoakheti study sites

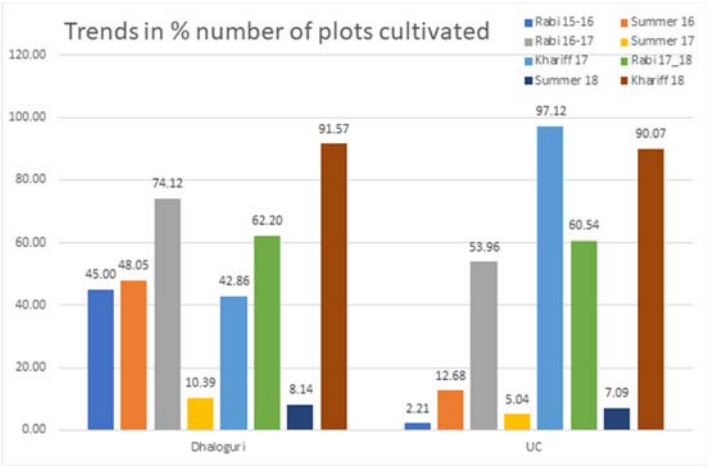


Figure 5: Seasonal trends in percentage of plots cultivated (Dholaguri and Uttar Chakoakethi)

Dholaguri

Dholaguri site is located at latitude 26.428^{0}E longitude 89.493^{0}N. The area is characterized with Eutric Haplic Gleysols with slightly acidic pH of around 5.7. The soil texture is sandy clay loam. The average temperatures across the region range between 12^{0}C - 22^{0}C in winter and 27^{0}C - 33^{0}C summer. The average annual rainfall is 5300mm, mainly from the South-West monsoon.

Dholaguri village is rich in both surface and subsurface water resources. There is one perennial river, the Ghargharia, with over 20 ponds, which are seasonal and used mainly for fish production with only minor supplementary irrigation in drought years. There are a high density of shallow tube wells used for both domestic and irrigation purposes. The depth to groundwater varies between 1.5 to 4.5 m. The quality of groundwater is generally good.

Three demonstration sites were established with a total area of 3.4ha. A number of tubewells and ponds were identified for water level monitoring (see Figure 6 and Appendix 2).

Uttar Chakoakheti Village – Alipurduar District

The Uttar Chakoakheti study site is located in Alipurduar District, West Bengal at latitude 26.547^{0}N longitude 89.401^{0}E and. The area is dominated by Haplic Gleysol soil with sandy clay loam soil texture and high infiltration capacity. The district is characterized by a warm and humid climate with summer temperatures ranging from 25-37^{0}C and winter 6-18^{0}C.

Six ponds were located in the project area, however due to the high infiltration capacity of the sandy soil material, no substantial storage is retained for summer irrigation. Depth to groundwater typically varies between 0.5 – 3.0m after monsoon rains and 4-6m at the end of the dry summer season. Four demonstration sites were established with a total area of 7.2ha

General groundwater water quality across Cooch Behar and Alipurduar District, is of good quality for both domestic and agricultural use, however elevated iron content ranging from 0.04 – 10.2 mg/l suggests need for monitoring to avoid arsenic contamination.

Madhubani District

Madhubani District has an average annual rainfall of approximately 1200mm, winter temperatures of 9-22^{0}C and summer temperatures of 27-36^{0}C. Madhubani, geologically lies along the alluvial plains of the north terai, characterized by low-lying waterlogged areas, classified as an Entisol. The groundwater quality in Madhubani District is generally considered suitable for irrigation purposes.

A total of 68 plots were monitored across the four sites at Bhagwatipur and 13 plots in Mauahi. Figure 7 summarises the percentage of plots cropped across seasons, and the increase in cropping intensity through introduction of Rabi and summer season crops. Monsoon rice is supplemented by Rabi crops of peas, potato, radish, cauliflower, spinach, lentil and wheat and summer crops of chilli, cowpea, cucumber, brinjal, gourd, ladyfinger and moong bean.

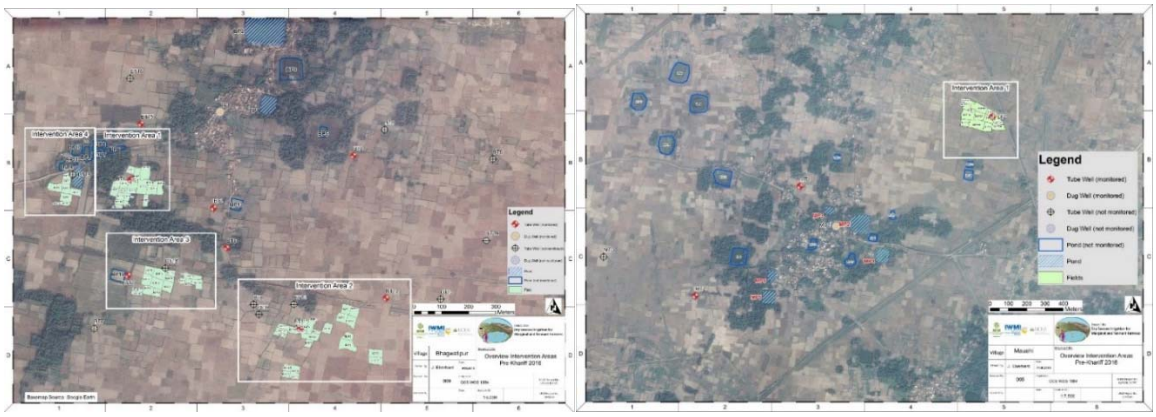


Figure 6: Bhagwatipur and Mauahi study sites

Bhagwatipur Village

Bhagwatipur site is located at latitude 26.352^{0}N longitude 86.340^{0}E. The area is composed of Haplic Vertisols with high clay contents (around 33%). The soils are generally neutral with soil pH of around 6.6 and soils within 90cm of ground surface are generally of clay loam structure.

Across the greater Bhagwatipur village 16 permanent and 9 temporary ponds were identified with size ranging from 200 – 17000 m^2. Most ponds are used for fishery and domestic use, although a few are used for supplementary irrigation, especially during land preparation and minimal dry season vegetable cropping. Depth to groundwater range between 2-3m below ground level in September and 4-5m below ground level in July. Tubewells and ponds are indicated in Attachment 5.1b. Four demonstration sites were established with a total area of 5.5ha.

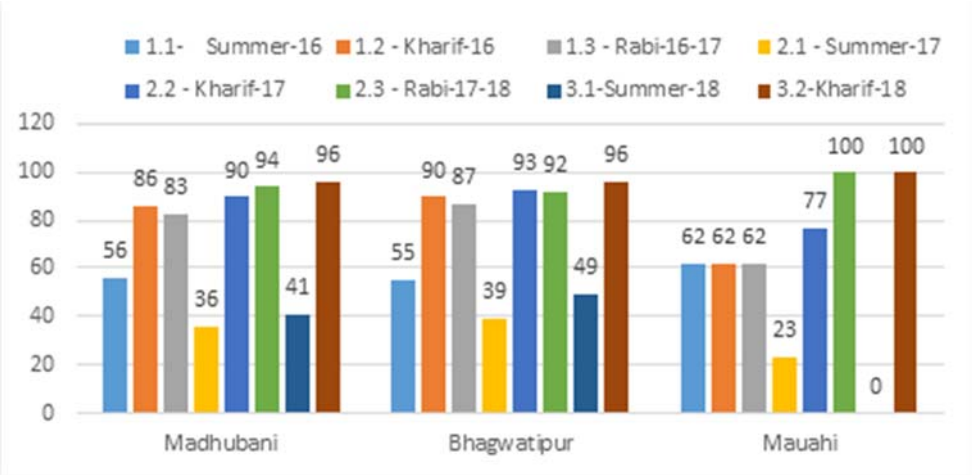


Figure 7: Seasonal trends in percentage of plots cultivated (Madhubani combined and Bhagatipur and Mauahi)

Mauahi Village

Mauahi Village study site is located at latitude 26.442^{0}N longitude 86.298^{0}E. Soils in the area are classified as Haplic Vertisols, with high clay contents above 30%.

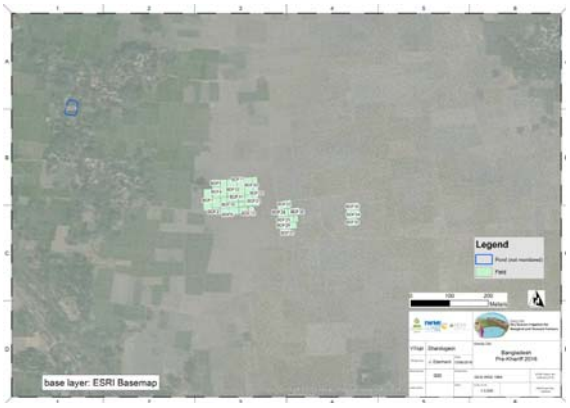
Seventeen temporary ponds and twenty four permanent ponds ranging in sizes from 200m2 to 15,000m^2 were identified. Monsoonal rain and recharge fills the pond with gradual decline in water depth due to seepage and evaporation loss with occasional sharp drop in the water levels during an irrigation-pumping event. The groundwater level varies significantly across Mauahi Village both temporally and spatially. Greatest depth to groundwater is 6m recorded during pre-monsoon pumping for paddy field seedbed and field preparations. One demonstration site was established with a total area of 2.2ha.

Bangladesh Sites

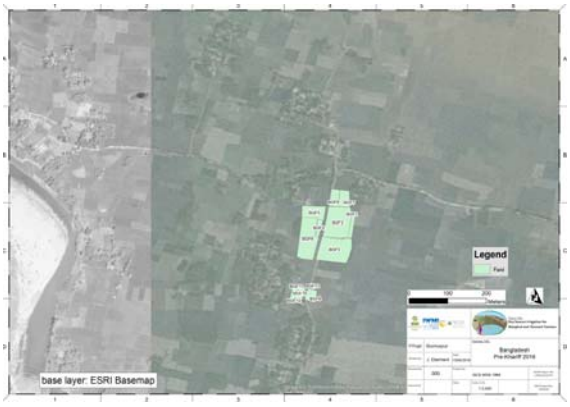
In northwest Bangladesh the project aim was to better understand the bio-physical, socio-economic and institutional aspects of groundwater irrigation, through intensive monitoring of groundwater irrigation.

Six sites were selected, one in each of Rajshahi, Pabna, Bogura, Rangpur, Dinajpur and Thakurgaon Districts (Figure 1b). The project only focussed on the Rangpur, Bogura, Pabna and Thakurgaon sites following the first season of baseline data collection. For detail see Mainuddin et al (2019 – Report No 18). Appendix 2 gives locality maps. A brief summary of monitored sites is provided below and in Table 2, which summarises characteristics of tubewell monitoring sites including command area, number of farmers and major crops. Sites targeted mainly tribal, marginal and tenant farmers. Figure 8 provides overview maps, details are given in Appendix 2.

Rajshahi and Thakurgaon represent deep tubewell (DTW) irrigation zones and the other four sites shallow tubewell (STW) irrigation zones, although a mix of both DTW and STW irrigation is practiced. A mix of both diesel and electric pump arrangements and different water pricing mechanisms were targeted in site selection. Cropping systems comprised irrigated rice, complemented by other crops such as potato, tomato, wheat and maize.



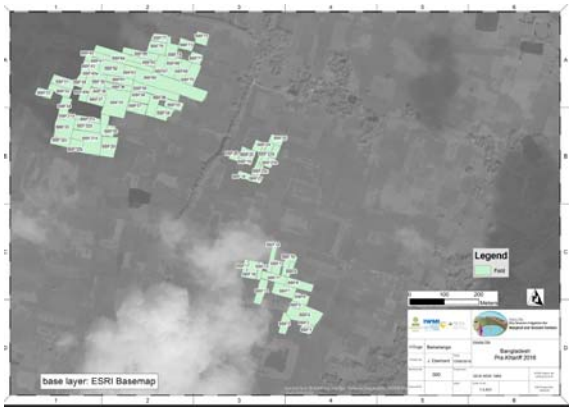
Thakurgaon (Dhandogaon)



Dinjapur (Gurnurpur)

Rangpur (Mithapukur)

Bogra (Arongshail)



Pabna (Baliadangi)

Rajshahi (Panchandar)

Figure 8: Bangladesh Study Sites

The region has a dry humid climate with annual rainfall varying from 1,273 to 2,515 mm (average 1,927 mm) and average reference evapotranspiration, ETo of 1,310 mm. There is significant variation of rainfall within the region. Rajshahi has the lowest average annual rainfall (1,428 mm) and Rangpur the highest (2,262 mm). The monthly distribution of rainfall shows almost 82% of rainfall occurs during the monsoon season (May–October) and 18% of rainfall occurs during the dry season (November–May). In terms of temperature, monthly average temperature ranges from 25 to 35°C in the hottest season and 9–15° C in the coolest season.

Cropping season is classified into two groups, Kharif crops and Rabi crops. Kharif crops are grown in the spring or summer season and harvested in late summer or in early winter. Kharif season is divided into Kharif-I (March to June) and Kharif-II (July to October). Rabi (November to February) crops are sown in winter and harvested in the spring or early summer. Kharif crops are mostly rainfed and partially irrigated as they are grown in pre-monsoon and monsoon season. Rabi crops are grown in dry season with very little rainfall and are mostly irrigated.

Thakurgaon

Three electrically operated deep tube wells were selected, in the village of Dhandogaon, with cultivation of maize, wheat, mustard and potato, although irrigated rice remains the main dry season crop.

Photo 1 DTW site at Thakurgaon (Dhandogaon)

Dinajpur

Three diesel and two electric shallow tubewells were selected in the Gurnurpur village of Kaharol. There is widespread coverage of maize, mustard, potato and wheat although rice remains the main crop in the dry season.

Photo 2. STW site at Dinajpur (Gurnurpur)

Rangpur

Six STWs were selected at Ramnatherpara village, of which one is electrically driven and five diesel operated. Main dry season crops are irrigated rice, maize, mustard, potato, wheat, vegetables, spices and pulses.

Photo 3. STW site at Rangpur (Mithapukur)

Bogura

Six diesel operated STWs selected in the Arongshail village. Rice is the main crop of the area with maize, wheat, potato, vegetables, spices, oil seeds and pulses the other major non-rice crops.

Photo 4: STW site at Bogura (Arongshail)

Pabna

Three diesel and two electric STWs selected at Baliadangi village. Irrigated rice is the main dry season crop, other crops include maize, wheat, potato, vegetables, spices, oil seeds and pulses, cultivated in the highland. The static water level crosses the suction limit of STWs during the dry season. Therefore, the STWs are installed deeper by digging a pit with 1-2 meter depth.

Figure 5 STW site at Pabna (Baliadangi)

Rajshahi

Three electric DTW irrigation sites in Pachandar village. The static water level is far below the suction limit of STW coverage. Most of the DTWs are installed by the Barind Multipurpose Development Authority (BMDA). Some low capacity private DTWs (Mini-DTW) are also used

for irrigation. Irrigated rice is the main dry season crop of the area, with maize, wheat, potato, spices, oil seeds and pulses are also cultivated.



Photo DTW site at Rajshahi (Pachandar)

In total 22 STW and 6 DTWs were selected across the six sites in 2015-16 season. All plots under the command area of the STWs were monitored. As the command area of the DTW are large only the plots supplied by three outlets were monitored.

Table 2 Characteristics of selected STW and DTW monitoring sites.

Site	Type of tubewell	Power source	Discharge capacity (lit/sec)	Command area (ha)	Total no. of plots	Number of farmers	Major crops
Thakurgaon	DTW-1	Electric	58.0	24.3	100	60	Rice, wheat, maize, potato
	DTW-2	Electric	38.5	16.5	85	46	Rice, wheat, maize
	DTW-3	Electric	36.8	13.8	78	43	Rice, wheat, maize, potato
Dinajpur	STW-1	Electric	13.2	2.02	8	2	Rice
	STW-2	Diesel	8.91	0.50	5	3	Rice
	STW-3	Electric	14.0	1.80	11	6	Rice
	STW-4	Diesel	8.78	0.95	9	5	Maize
	STW-5	Diesel	8.85	0.81	1	1	Maize
Rangpur	STW-1	Electric	14.82	2.77	65	23	Rice, jute, maize, wheat, potato
	STW-2	Diesel	8.77	1.17	13	10	Rice
	STW-3	Diesel	9.43	1.17	10	8	Rice
	STW-4	Diesel	9.87	2.41	17	10	Rice, maize
	STW-5	Diesel	8.45	1.42	16	11	Maize, wheat, brinjal, tomato, cauliflower
	STW-6	Diesel	8.89	3.00	20	15	Maize, potato, brinjal, onion
Bogura	STW-1	Diesel	7.13	1.28	10	4	Rice
	STW-2	Diesel	7.24	1.84	13	3	Rice

	STW-3	Diesel	7.32	3.04	29	5	Rice
	STW-4	Diesel	7.12	0.62	8	5	Potato, mustard
	STW-5	Diesel	7.04	0.30	4	4	Wheat
	STW-6	Diesel	7.20	0.31	3	1	Maize
Pabna	STW-1	Electric	12.86	1.87	6	6	Rice
	STW-2	Diesel	14.0	2.94	19	12	Rice
	STW-3	Electric	15.02	4.60	25	22	Rice
	STW-4	Diesel	8.12	1.63	11	11	Wheat, lentil
	STW-5	Diesel	8.56	2.13	17	15	Wheat, lentil, okra
Rajshahi	DTW-1	Electric	17.0	16.0	84	56	Rice, wheat, potato, lentil
	DTW-2	Electric	20.0	20.0	98	72	Rice, wheat, potato
	DTW-3	Electric	21.5	20.0	108	84	Potato, Rice

In 2016-17, we discarded monitoring in Rajshahi and Dinajpur and added a solar irrigation scheme in Badarganj, Rangpur. No of STW monitoring was also reduced in Bogura, Pabna and Rangpur.