Groundwater Rejuvenation As Climate Change Resilience for marginalized and gender sensitive Ganges (GRACERS)

Study Team

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***Proceedings of* Workshop March 2022**

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1. Background

Many streams that feed into the Ganges River are converting from perennial to seasonal, thus limiting stream water flow in non-monsoon periods. This is due to the combined effect of climate change and anthropogenic factors. As a result, the groundwater levels in the Ganges basin are falling down sharply, and are affecting the rural communities who depend on groundwater for domestic and irrigation water supply. Village wells are running dry, and women are forced to go far distances to fetch water, leading to social and economic stress and loss of school time for girls, while fetching water. If local systems are constructed to capture rainfall and increase groundwater recharge, both the quality and quantity of groundwater will increase. If decentralized/distributed infrastructure is built, the groundwater levels will be increased simultaneously across the basin. Also, local rainfall can be captured to sustain domestic water use. Therefore, by constructing groundwater recharge structures in a decentralized approach, the villages can easily store the rainwater and allow it to recharge the groundwater levels. This will allow monsoon rainfall to be stored in the soil layers and delay runoff into the rivers, thus leading to sustained well water levels in dry periods and reduction in peak floods in the main channel. To install these groundwater recharge structures, vulnerability assessment maps and feasibility location maps are needed. The feasibility location maps will take into account physical factors (e.g., geology, hydrology, climate, and distance to wells), social (e.g. representation of and near to marginalized community wells) and economic factors (e.g. procuring land, mobilization of village communities). Village surveys helps for producing social-economic scenario which can be considered in identifying hotspots of the vulnerable areas.

Therefore, National Institute of Hydrology (NIH) Roorkee along with the Indian Institute of Technology Bombay (IITB) is conducting the study project "Groundwater Rejuvenation Resilience as Climate Change for marginalized and gender sensitive Ganges (GRACERS). One site (Nandigram and Haldia block of Purba Medinipur district) in Indian Ganges delta and two sites (Naogaon and Khulna district) in Bangladesh Ganges delta regions are identified for this project. The aim of this project is to produce feasibility maps for decentralized/distributed groundwater recharge in the Ganges basin. The project findings have been sensitized the groundwater issues and propose sites and methods to increase groundwater recharge. This project output will help us making effective adaptive strategies in changing climatic conditions in the coastal regions.

The top academic and research institutes i.e., IIT Bombay & IHE Delft, civil society (NM Sadguru) and government agencies NIH, India & IWM, Bangladesh are involved with this project. This two-year project is funded by DUPC and UN-IHE, Netherlands. In the meanwhile, NIH and IIT Bombay has prepared a draft report including vulnerability maps for groundwater stressed areas and hotspots for decentralized groundwater recharge.

To exchange the study findings and to gather feedbacks, comments and suggestions from the concerned Stakeholders, Organizations, Local Authorities, Experts and Marginalized peoples, a stakeholders consultation workshop was organized by NIH Roorkee in collaboration with IIT Bombay. The workshop was organized at Haldia in the Purba Medinipur district of West Bengal on March 22, 2022 with local support of the State Water Investigation Directorate (SWID), Government of West Bengal (GoWB). The workshop was focused on the groundwater depletion scenario in the Haldia and Nandigram blocks of the Purba Medinipur district. The findings from the project are shared with local stakeholders and government officials. Dr. Sudhir Kumar, Scientist-G and Head, HI Division, NIH Roorkee was the Chief guest and Sh. Arindam Ghosh, Director, SWID was the guest of honor of the workshop

presided by Sh. Sanjay Das, Block Development Officer (BDO), Haldia Development Block, Shri. Subrata Hazra, Sabhapati, Haldia Panchayat Samity, Sh. Subrata Haldar, Executive Engineer, SWID. Prof. Pennan Chinnasamy, CTARA, IITB and GRACERS Project Principal Investigator, India attended the workshop virtually as Special Guest.

2. Research Objectives:

The main research objective is to identify hot-spots for decentralized and distributed groundwater recharge networks. The specific objectives of the project are:

- Identify change in drinking water supply sources for rural, marginalized and women communities
- Identify socio-economic stress due to poor groundwater quality and quantity
- Identify loss of labor time and education time due to water fetching activities
- Identify health issues in consuming polluted water and long-term impacts
- Understand limitations in current water diplomacy and potential recommendations to the Government
- Identify limitations in groundwater recharge due to centralized water supply schemes
- Identify potential private ownership models for rural communities to sustainably manage recharge structures, once key funders exit
- Provide knowledge and technical support to government agencies working in the Ganges basin
- Provide scientifically validated management plans for up-scaling distributed groundwater recharge networks.

3. Opening Session:

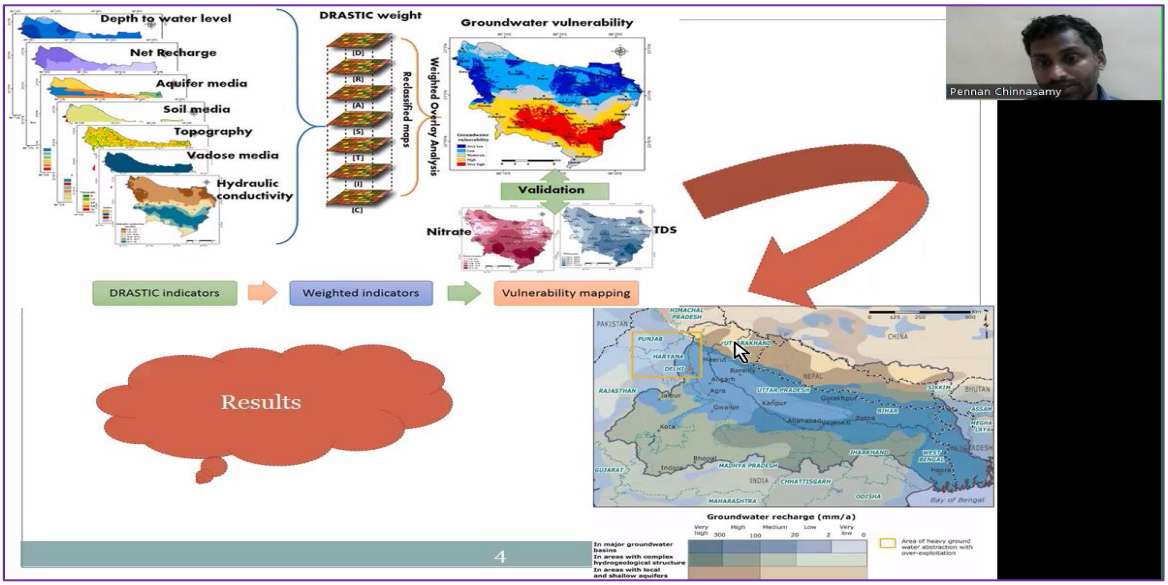
The workshop was held on occasion of World Water Day, March 22, 2022 with the theme on groundwater "The making invisible visible" at B.D.O. Office conference room, Haldia, Purba Medinipur (Fig.1). The day began with registration of participants at 9:30 AM. Around 50 participants from different local authorities, organisations and of different occupation including marginalized men & women attended the workshop (Table 1). After guests took their respective seats, Dr. Santosh Pingale warmly welcomed the participants, acknowledging the different concerned stakeholders, organizations that were represented, and provided the brief background and objectives of the study and this workshop. In his welcome address, Dr. Santosh Pingale mentioned that groundwater level in some places of Haldia and Nandigram blocks are decreasing day by day which would create many environmental problems in near future. To countermeasure these issues, it is important to identify the hot spots for decentralized and distributed groundwater recharge networks.

After his welcome address, Dr. Pingale requested all the participants to introduce themselves. After introduction of the guests, Dr. Pingale requested to Chief Guest Dr. Sudhir Kumar to give Inaugural Address. Sh. Arindam Ghosh, Director, State Water Investigation Directorate (SWID) in his guest of honour speech shared various groundwater management efforts taken by the GoWB. Also, the workshop was presided by Sh. Sanjay Das, Block Development Officer (BDO), Haldia Development Block and Shri. Subrata Hazra, Sabhapati, Haldia Panchayat Samity, Sh. Subrata Haldar, Executive Engineer, SWID.

Figure 1 Banner of the workshop

4. Technical Presentations:

Dr. Pennan Chinnasamy gave an overview of the Project (Figure 2). Dr. Pingale gave detail presentation on the progress and key findings of the GRACERS project on "Groundwater Rejuvenation as Climate Change Resilience for marginalized and gender sensitive Ganges (GRACERS)" in the workshop (Figure 3). In his presentation, Dr. Santosh Pingale provided a brief on objectives, scope of works, study area, methodology and study key findings. The specific objective of this project was to identify limitations in groundwater recharge due to centralized water supply system, understand limitations in current water diplomacy as well as find out potential private ownership models for rural communities to sustainably manage recharge structures once key funders exit. He showed, the primary and secondary data collected from the study area, groundwater issues in the study regions, development of vulnerability maps for groundwater stress and hotspots for decentralized groundwater recharge network and development of conceptual model.



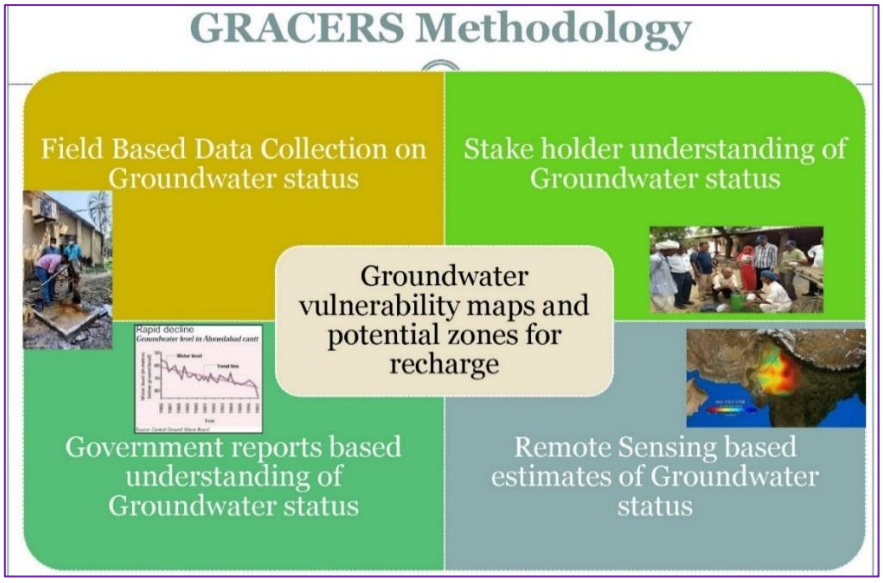
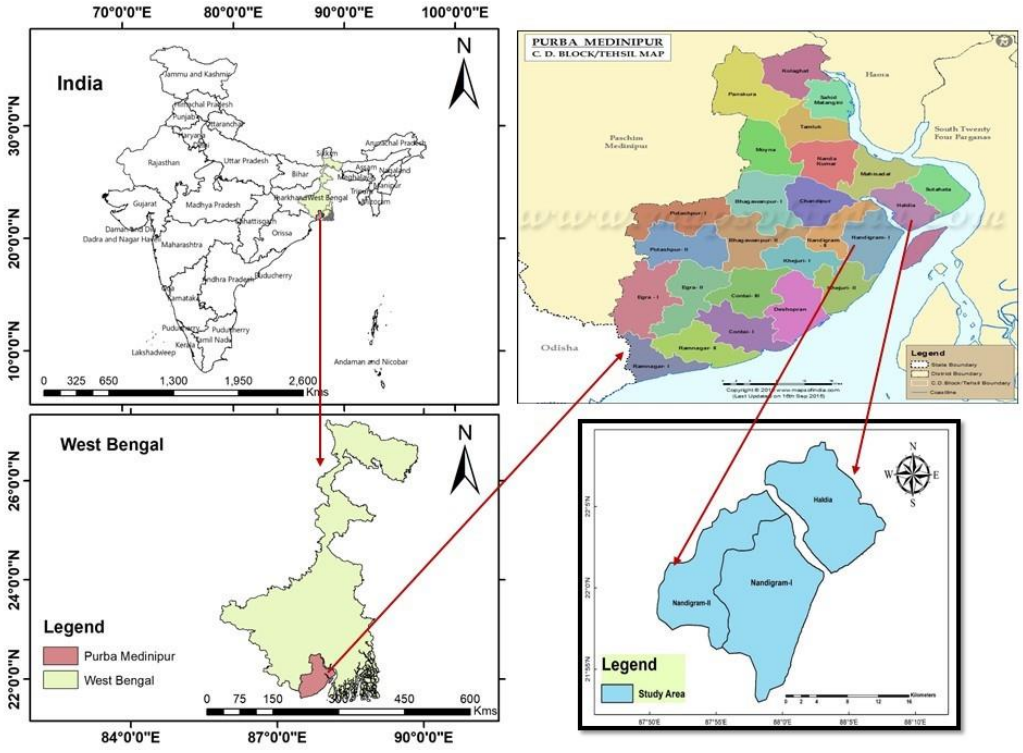


Figure 2: Presentation by Prof. Pennan Chinnasamy, IIT Mumbai virtually

He mentioned that in the past, indigenous people could not use the well of rich families due to social discrimination. Though the situation has been improved but is still present. People still faces some social humiliation and have to collect water from the Hand Pump located far away from their homes. Considering the factors of poor households, indigenous households, unhygienic water sources and high-water scarcity the most vulnerable area was Haldia. Due to water crisis, people did not receive sufficient water (in quantity and quality) and they faced various health related issues.

From the implementing agencies & Government official Sh. Subrata Haldar gave technical presentation on the groundwater management issues and importance of monitoring groundwater levels in the study area & initiatives being taken by the SWID, GoWB (Figure 4).



(a)

(b)

Figure 3: a) Location of the study area & b) GRACERS project progress presentation by Dr. Santosh Pingale

Figure 4: Presentation by Sh. Subrata Haldar, Executive Engineer, SWID

5. Open Discussion:

After the end of the technical presentations, the discussion was started. In this session participants were divided into four groups:

- Group 1. Representatives of Haldia block
- Group 2: Representatives of Haldia Panchayat Samity
- Group 3: Implementing agencies & Government officials
- Group 4: Vulnerable Groups & Users

Each group were asked to discuss among them on the issues provided to them and to give the most suitable answer against each question. They were asked to give the answer considering their practical situations. For each group, they were provided a total of 10 questions. The groups and their discussion topics is shown in Figure 5.

The groups were formed in such a way that we could get perspective from both the indigenous people, vulnerable group (women) because they spent a significant amount of time for collection of water. The implementation organizations were also included as they are responsible for constructing for tube wells or dug wells or other means to facilitate the drinking, domestic or irrigation water in this area. A questionary was provided to each group where they could share their thoughts from their point of view.

স্টেকহোল্ডারদের পরামর্শ কর্মশালা
(Stakeholder's Consultation Workshop)
চালু (On)
জলবায়ু পরিবর্তনের স্থিতিস্থাপকতা হিসাবে প্রান্তিক, পুরুষ ও মহিলা সংবেদনশীল গাঙ্গেয় পশ্চিমবঙ্গে ভূগর্ভস্থ জলের পুনর্জীবন
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ভেন্যু: হলদিয়া, পূর্ব মেদিনীপুর, পশ্চিমবঙ্গ
(Venue: Haldia, Purba Medinipur, West Bengal)
Date: March 22, 2022 (Tuesday)

গোষ্ঠী (Groups):

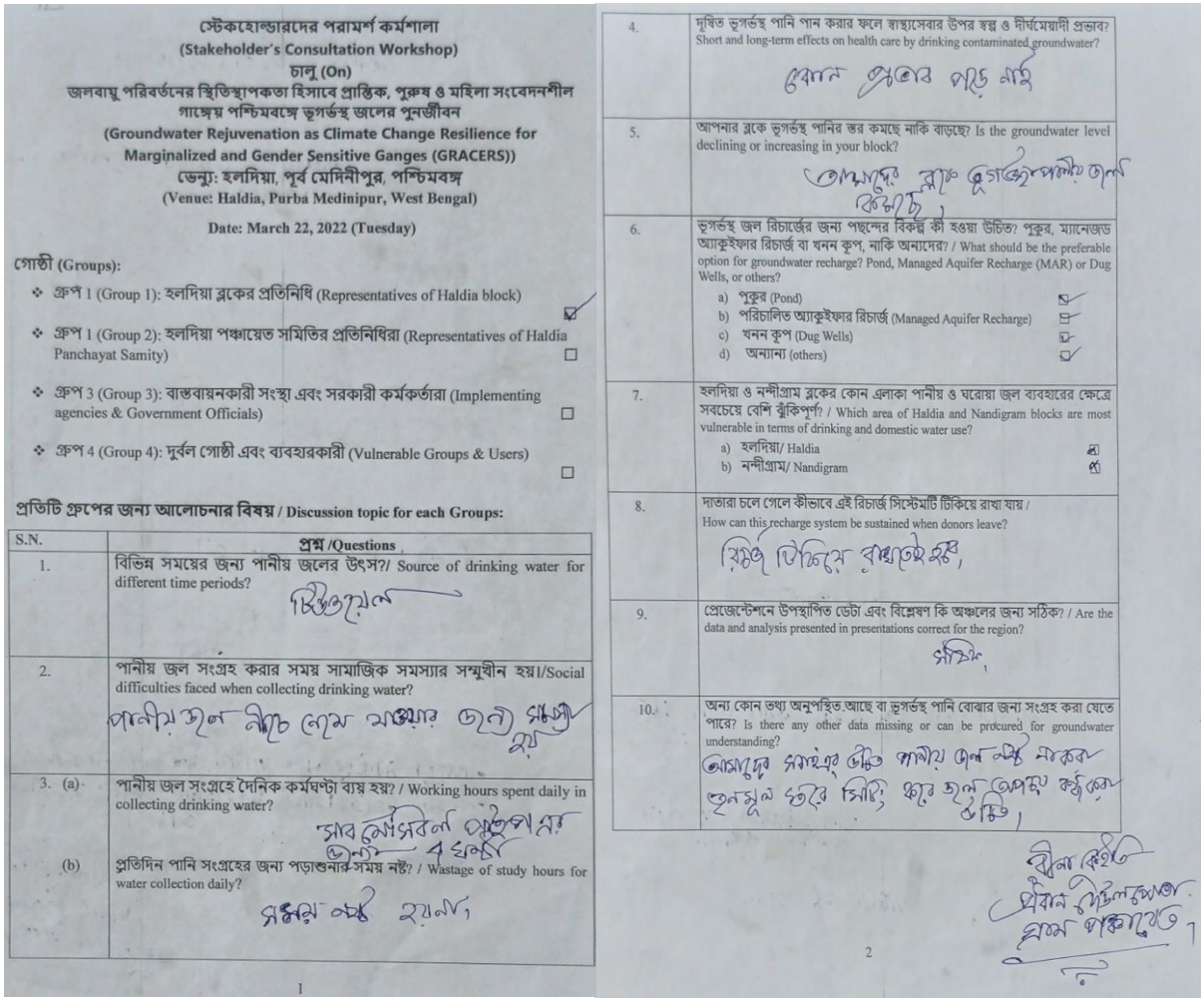
- গ্রুপ 1 (Group 1): হলদিয়া ব্লকের প্রতিনিধি (Representatives of Haldia block) ☐
- গ্রুপ 1 (Group 2): হলদিয়া পঞ্চায়েত সমিতির প্রতিনিধিরা (Representatives of Haldia Panchayat Samity) ☐
- গ্রুপ 3 (Group 3): বাস্তবায়নকারী সংস্থা এবং সরকারী কর্মকর্তারা (Implementing agencies & Government Officials) ☐
- গ্রুপ 4 (Group 4): দুর্বল গোষ্ঠী এবং ব্যবহারকারী (Vulnerable Groups & Users) ☐

প্রতিটি গ্রুপের জন্য আলোচনার বিষয় / Discussion topic for each Groups:

S.N.	প্রশ্ন /Questions
1.	বিভিন্ন সময়ের জন্য পানীয় জলের উৎস?/ Source of drinking water for different time periods?
2.	পানীয় জল সংগ্রহ করার সময় সামাজিক সমস্যার সম্মুখীন হয়।/Social difficulties faced when collecting drinking water?
3. (a)	পানীয় জল সংগ্রহে দৈনিক কর্মঘণ্টা ব্যয় হয়? / Working hours spent daily in collecting drinking water?
(b)	প্রতিদিন পানি সংগ্রহের জন্য পড়াশুনার সময় নষ্ট? / Wastage of study hours for water collection daily?
4.	দূষিত ভূগর্ভস্থ পানি পান করার ফলে স্বাস্থ্যসেবার উপর স্বল্প ও দীর্ঘমেয়াদী প্রভাব? Short and long-term effects on health care by drinking contaminated groundwater?
5.	আপনার ব্লকে ভূগর্ভস্থ পানির স্তর কমছে নাকি বাড়ছে? Is the groundwater level declining or increasing in your block?
6.	ভূগর্ভস্থ জল রিচার্জের জন্য পছন্দের বিকল্প কী হওয়া উচিত? পুকুর, ম্যানেজড অ্যাকুইফার রিচার্জ বা খনন কূপ, নাকি অন্যদের? / What should be the preferable option for groundwater recharge? Pond, Managed Aquifer Recharge (MAR) or Dug Wells, or others? a) পুকুর (Pond) ☐ b) পরিচালিত অ্যাকুইফার রিচার্জ (Managed Aquifer Recharge) ☐ c) খনন কূপ (Dug Wells) ☐ d) অন্যান্য (others) ☐
7.	হলদিয়া ও নন্দীগ্রাম ব্লকের কোন এলাকা পানীয় ও ঘরোয়া জল ব্যবহারের ক্ষেত্রে সবচেয়ে বেশি ঝুঁকিপূর্ণ? / Which area of Haldia and Nandigram blocks are most vulnerable in terms of drinking and domestic water use? a) হলদিয়া/ Haldia ☐ b) নন্দীগ্রাম/ Nandigram ☐
8.	দাতারা চলে গেলে কীভাবে এই রিচার্জ সিস্টেমটি টিকিয়ে রাখা যায় / How can this recharge system be sustained when donors leave?
9.	প্রেজেন্টেশনে উপস্থাপিত ডেটা এবং বিশ্লেষণ কি অঞ্চলের জন্য সঠিক? / Are the data and analysis presented in presentations correct for the region?
10.	অন্য কোন তথ্য অনুপস্থিত আছে বা ভূগর্ভস্থ পানি বোঝার জন্য সংগ্রহ করা যেতে পারে? Is there any other data missing or can be procured for groundwater understanding?

Figure 5: Questionnaire for discussion in Workshop

According to Group 1, people of Haldia were used pond water for drinking in earlier time and now mostly they used groundwater through Tube well and Submersible Pumps (Figure 6). In response of the question 2 in the questionnaire, they stated that, people faced social difficulties for collecting water. In Haldia, the water sources were far away from their residence which was almost one to 2km on average according to the group 1. As a result, it took 1-2 hrs to collect water before the establishment of other sources. But with time, after installation of several tube wells, dug well and other facilities. The collection time reduced to 30 minutes in Haldia. They also stated that, people in Haldia and near to Haldia suffered health related issues due to insufficient and contaminated drinking water.



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1

4.	দূষিত ভূগর্ভস্থ পানি পান করার ফলে স্বাস্থ্যসেবার উপর স্বল্প ও দীর্ঘমেয়াদী প্রভাব? Short and long-term effects on health care by drinking contaminated groundwater?
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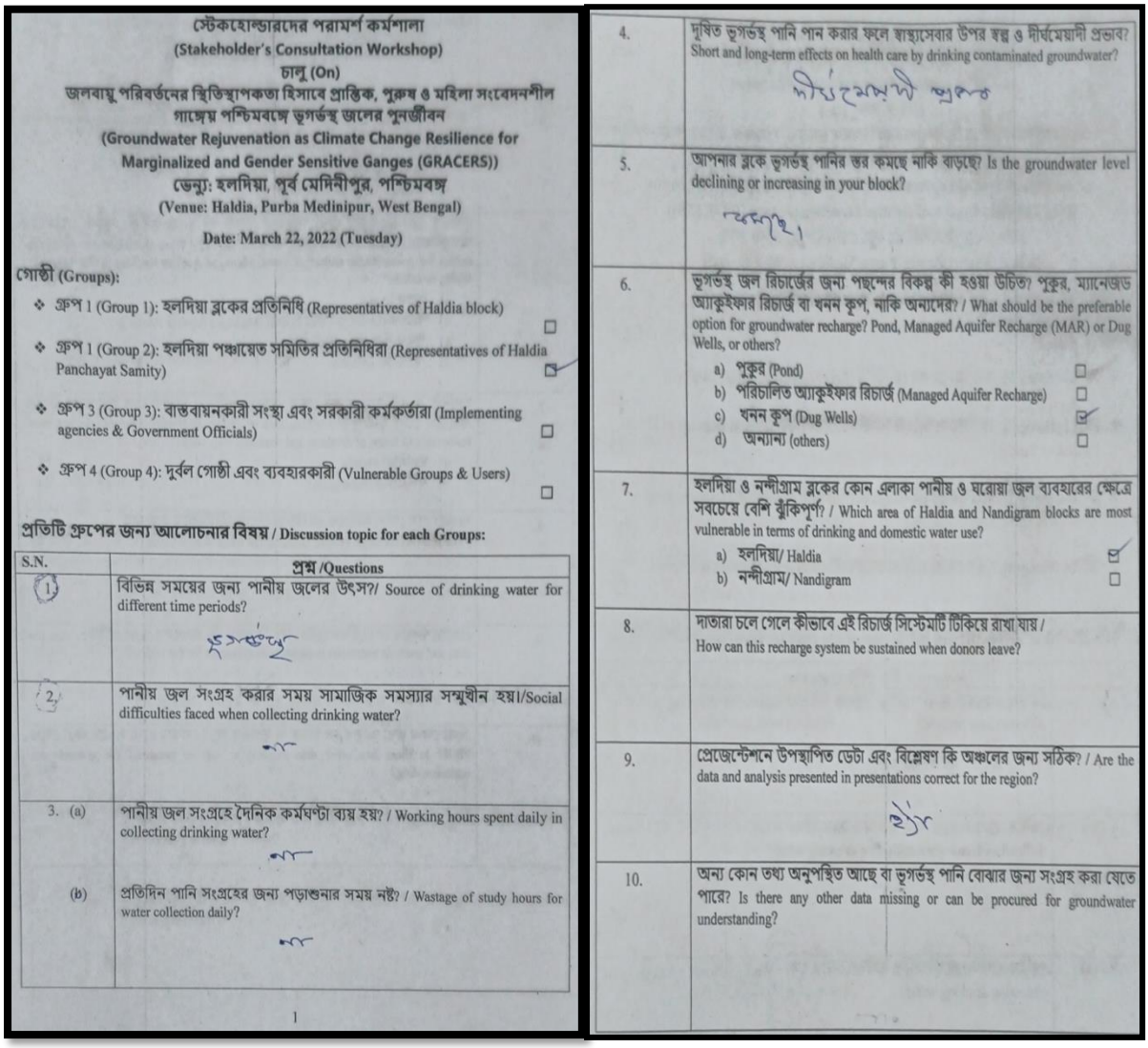
2

Figure 6: Questionnaire answers of Group 1

Here, among all the alternatives, people from group 1 preferred rain water harvesting for groundwater recharge. They also suggested that after leaving the donor group, a committee may be formed with the member of beneficiaries of the water sources for making the sources sustainable. Group 1 agreed with the findings of the result of the research project. However, they suggested that more research work and awareness regarding water resource management should be conducted.

Group 2, the representatives of Haldia Panchayat Samity mentioned that ponds were the primary source of drinking water, currently they are using dug well and submersible pump for drinking water purposes. However, the people from Haldia Panchayat Samity mentioned that, they face so much social difficulties for collecting drinking water. They required 1 to 2 hrs for

collecting drinking water and they face water scarcity in dry season (Figure 7). They recommended to dig more ponds and dug wells for groundwater recharge. Indigenous people of Haldia Panchayat Samity, mentioned that Haldia is the most vulnerable unions in terms of drinking and domestic water use. They also suggested forming a committee with the people from beneficiary for sustainable water recharge system when donors would leave. People agreed with the analysis presented in the workshop regarding their region.



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- গ্রুপ 1 (Group 1): হলদিয়া ব্লকের প্রতিনিধি (Representatives of Haldia block) ☐
- গ্রুপ 1 (Group 2): হলদিয়া পঞ্চায়েত সমিতির প্রতিনিধিরা (Representatives of Haldia Panchayat Samity) ☑
- গ্রুপ 3 (Group 3): বাস্তবায়নকারী সংস্থা এবং সরকারী কর্মকর্তারা (Implementing agencies & Government Officials) ☐
- গ্রুপ 4 (Group 4): দুর্বল গোষ্ঠী এবং ব্যবহারকারী (Vulnerable Groups & Users) ☐

প্রতিটি গ্রুপের জন্য আলোচনার বিষয় / Discussion topic for each Groups:

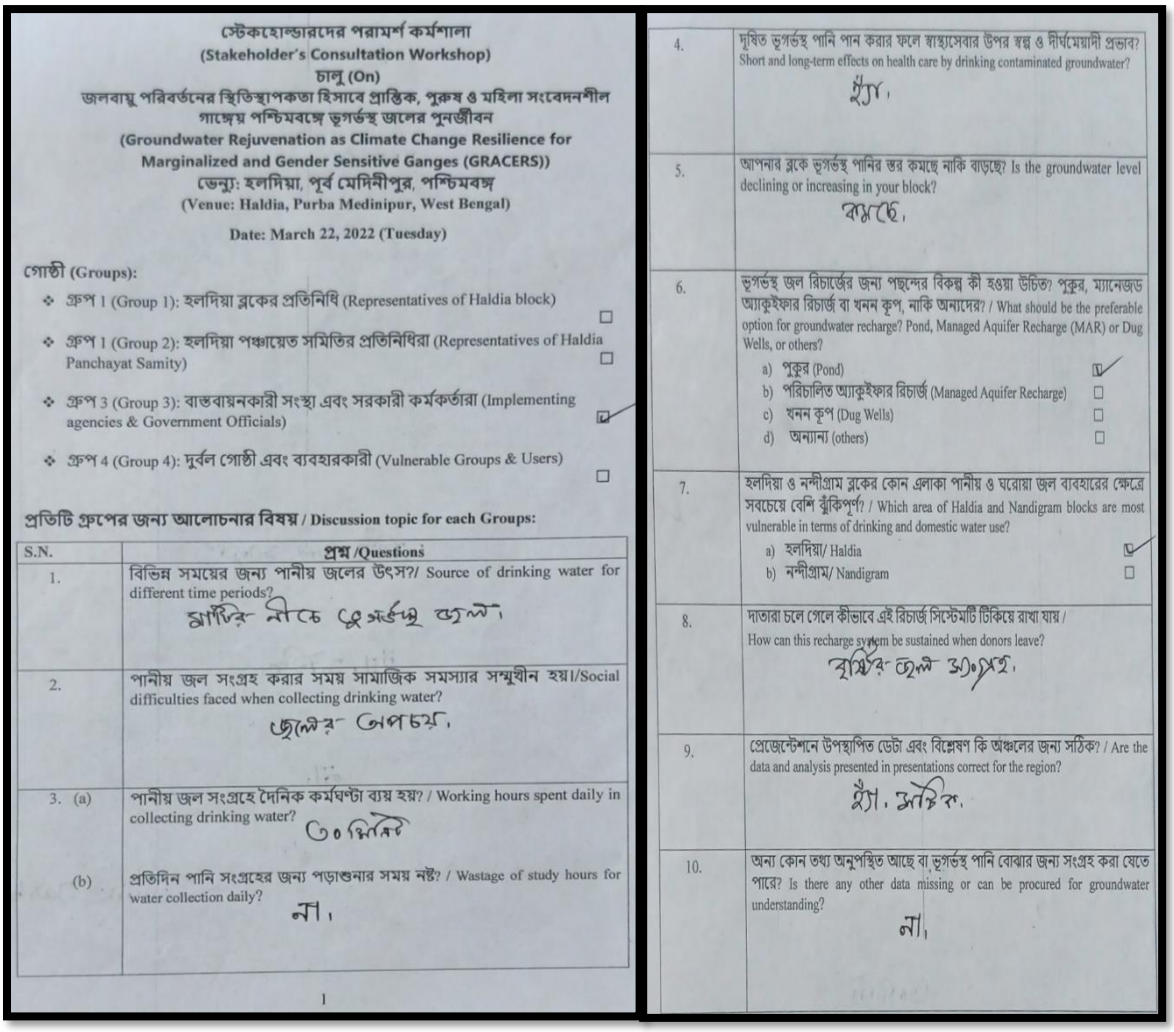
S.N.	প্রশ্ন /Questions
1	বিভিন্ন সময়ের জন্য পানীয় জলের উৎস?/ Source of drinking water for different time periods?
2	পানীয় জল সংগ্রহ করার সময় সামাজিক সমস্যার সম্মুখীন হয়।/Social difficulties faced when collecting drinking water?
3. (a)	পানীয় জল সংগ্রহে দৈনিক কর্মঘণ্টা ব্যয় হয়? / Working hours spent daily in collecting drinking water?
(b)	প্রতিদিন পানি সংগ্রহের জন্য পড়াশুনার সময় নষ্ট? / Wastage of study hours for water collection daily?

1

4.	দূষিত ভূগর্ভস্থ পানি পান করার ফলে স্বাস্থ্যসেবার উপর স্বল্প ও দীর্ঘমেয়াদী প্রভাব? Short and long-term effects on health care by drinking contaminated groundwater?
5.	আপনার ব্লকে ভূগর্ভস্থ পানির স্তর কমছে নাকি বাড়ছে? Is the groundwater level declining or increasing in your block?
6.	ভূগর্ভস্থ জল রিচার্জের জন্য পছন্দের বিকল্প কী হওয়া উচিত? পুকুর, ম্যানেজড অ্যাকুইফার রিচার্জ বা খনন কূপ, নাকি অন্যদের? / What should be the preferable option for groundwater recharge? Pond, Managed Aquifer Recharge (MAR) or Dug Wells, or others? a) পুকুর (Pond) ☐ b) পরিচালিত অ্যাকুইফার রিচার্জ (Managed Aquifer Recharge) ☐ c) খনন কূপ (Dug Wells) ☑ d) অন্যান্য (others) ☐
7.	হলদিয়া ও নন্দীগ্রাম ব্লকের কোন এলাকা পানীয় ও ঘরোয়া জল ব্যবহারের ক্ষেত্রে সবচেয়ে বেশি ঝুঁকিপূর্ণ? / Which area of Haldia and Nandigram blocks are most vulnerable in terms of drinking and domestic water use? a) হলদিয়া/ Haldia ☑ b) নন্দীগ্রাম/ Nandigram ☐
8.	দাতারা চলে গেলে কীভাবে এই রিচার্জ সিস্টেমটি টিকিয়ে রাখা যায় / How can this recharge system be sustained when donors leave?
9.	প্রেজেন্টেশনে উপস্থাপিত ডেটা এবং বিশ্লেষণ কি অঞ্চলের জন্য সঠিক? / Are the data and analysis presented in presentations correct for the region?
10.	অন্য কোন তথ্য অনুপস্থিত আছে বা ভূগর্ভস্থ পানি বোঝার জন্য সংগ্রহ করা যেতে পারে? Is there any other data missing or can be procured for groundwater understanding?

Figure 7: Questionnaire answers of Group 2

Group 3 was formed by government officials & implementation organizations representatives (Figure 8). There were officials of SWID and other implementing organizations in the study area. They also mentioned that ponds and groundwater were main sources of drinking water. Haldia Development Authority established dug well, deep tube well, ring well for facilitating drinking water source. Previously pond owners prevented people to use pond water for drinking purpose since pond water was used for agricultural purpose. They mentioned that people wasted 1-4 hrs daily for collection of drinking water, and students wasted 1-1.5 hrs of their study time daily for water collection. They suggested to construct more ponds, dug well for rainwater harvesting and promoting groundwater recharge.



স্টেকহোল্ডারদের পরামর্শ কর্মশালা
(Stakeholder's Consultation Workshop)
চালু (On)
জলবায়ু পরিবর্তনের স্থিতিস্থাপকতা হিসাবে প্রান্তিক, পুরুষ ও মহিলা সংবেদনশীল গাঙ্গেয় পশ্চিমবঙ্গ ভূগর্ভস্থ জলের পুনর্জীবন
(Groundwater Rejuvenation as Climate Change Resilience for Marginalized and Gender Sensitive Ganges (GRACERS))
ভেন্যু: হলদিয়া, পূর্ব মেদিনীপুর, পশ্চিমবঙ্গ
(Venue: Haldia, Purba Medinipur, West Bengal)
Date: March 22, 2022 (Tuesday)

গোষ্ঠী (Groups):

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প্রতিটি গ্রুপের জন্য আলোচনার বিষয় / Discussion topic for each Groups:

S.N.	প্রশ্ন /Questions
1.	বিভিন্ন সময়ের জন্য পানীয় জলের উৎস?/ Source of drinking water for different time periods? মাটির নীচে ভূগর্ভস্থ জল।
2.	পানীয় জল সংগ্রহ করার সময় সামাজিক সমস্যার সম্মুখীন হয়।/Social difficulties faced when collecting drinking water? ছেলেদের অপচয়।
3. (a)	পানীয় জল সংগ্রহে দৈনিক কর্মঘণ্টা ব্যয় হয়? / Working hours spent daily in collecting drinking water? ৩০ মিনিট
(b)	প্রতিদিন পানি সংগ্রহের জন্য পড়াশুনার সময় নষ্ট? / Wastage of study hours for water collection daily? না।

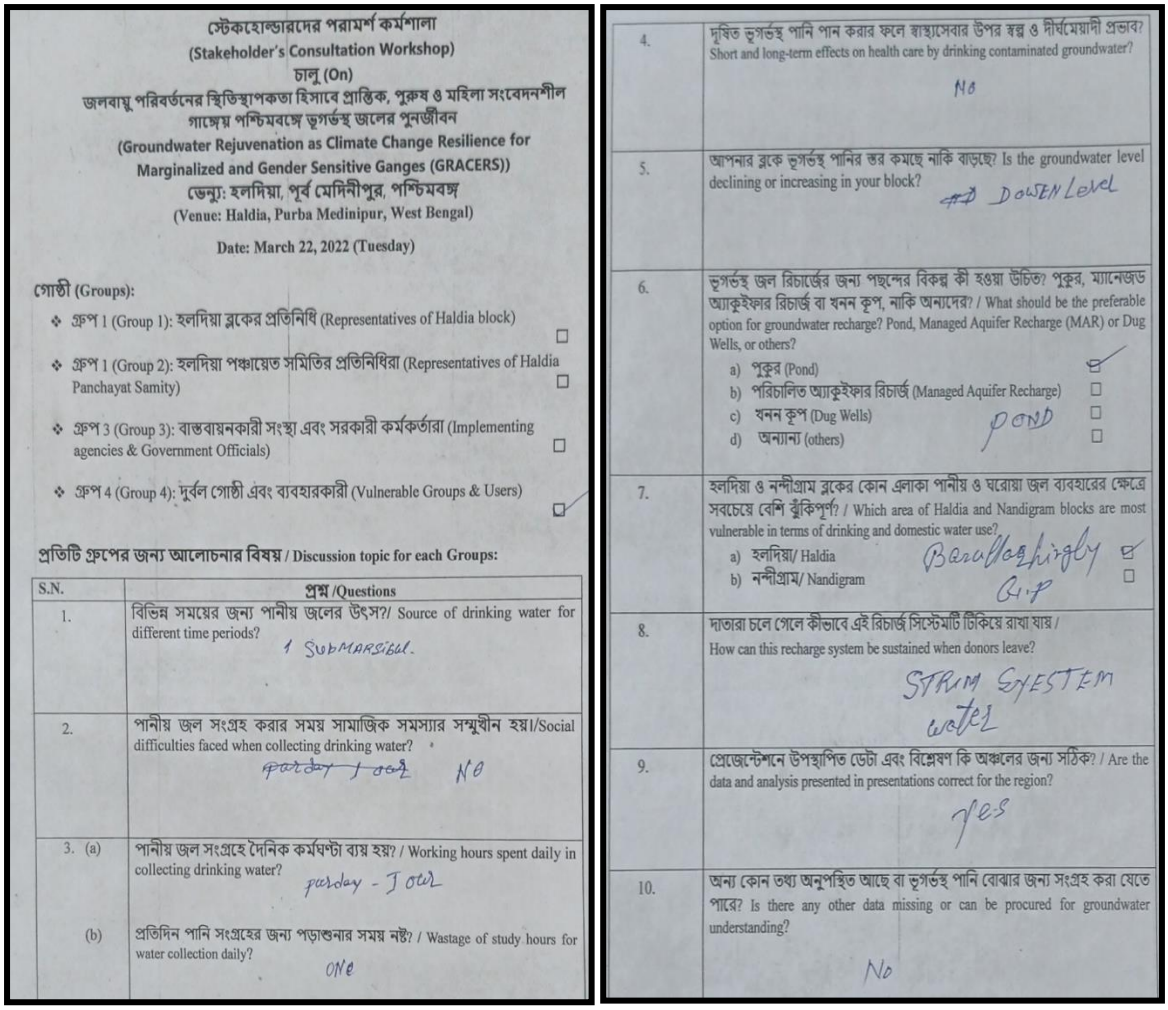
1

4.	দূষিত ভূগর্ভস্থ পানি পান করার ফলে স্বাস্থ্যসেবার উপর স্বল্প ও দীর্ঘমেয়াদী প্রভাব? Short and long-term effects on health care by drinking contaminated groundwater? হ্যাঁ।
5.	আপনার ব্লকে ভূগর্ভস্থ পানির স্তর কমছে নাকি বাড়ছে? Is the groundwater level declining or increasing in your block? কমছে।
6.	ভূগর্ভস্থ জল রিচার্জের জন্য পছন্দের বিকল্প কী হওয়া উচিত? পুকুর, ম্যানেজড অ্যাকুইফার রিচার্জ বা খনন কূপ, নাকি অন্যদের? / What should be the preferable option for groundwater recharge? Pond, Managed Aquifer Recharge (MAR) or Dug Wells, or others? a) পুকুর (Pond) ☑ b) পরিচালিত অ্যাকুইফার রিচার্জ (Managed Aquifer Recharge) ☐ c) খনন কূপ (Dug Wells) ☐ d) অন্যান্য (others) ☐
7.	হলদিয়া ও নন্দীগ্রাম ব্লকের কোন এলাকা পানীয় ও ঘরোয়া জল ব্যবহারের ক্ষেত্রে সবচেয়ে বেশি ঝুঁকিপূর্ণ? / Which area of Haldia and Nandigram blocks are most vulnerable in terms of drinking and domestic water use? a) হলদিয়া/ Haldia ☑ b) নন্দীগ্রাম/ Nandigram ☐
8.	দাতারা চলে গেলে কীভাবে এই রিচার্জ সিস্টেমটি টিকিয়ে রাখা যায় / How can this recharge system be sustained when donors leave? বৃষ্টির জল সংগ্রহ।
9.	প্রেজেন্টেশনে উপস্থাপিত ডেটা এবং বিশ্লেষণ কি অঞ্চলের জন্য সঠিক? / Are the data and analysis presented in presentations correct for the region? হ্যাঁ। সঠিক।
10.	অন্য কোন তথ্য অনুপস্থিত আছে বা ভূগর্ভস্থ পানি বোঝার জন্য সংগ্রহ করা যেতে পারে? Is there any other data missing or can be procured for groundwater understanding? না।

Figure 8: Questionnaire answers of Group 3

According to SWID and representatives of Panchyat Samity, some parts of Purba Medinipur including Haldia and Nandigram are vulnerable in terms of drinking and domestic water use. They suggested that government donation or a committee from beneficiary could maintain recharge systems to sustain when donors would leave while having open discussion. According to them, the data and analysis presented in the presentation were correct. However, they suggested to monitor groundwater regularly and raise awareness of proper usage and avoid over exploitation of groundwater.

Group 4, was formed from vulnerable groups and user's (Figure 9). They used pond and dug well water for drinking purpose for different time periods. After establishment of deep tube well and dug well they use it for drinking purpose. They wasted 1 hrs regularly for collecting water and students wasted 1 hrs from their study time to collect drinking water. People suffered by drinking contaminated water due to problem of Arsenic, Fluoride, and Salinity. They suggested to construct more rainwater harvesting structures to recharge groundwater in the Haldia block such as Barbajitpur, Chaul khola, Sutahata and Kapasaria villages. However, they believed they should form a committee for sustainable recharge system when donors would leave the support. They also opined that the data and analysis presented in the workshop were correct for their region.



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প্রতিটি গ্রুপের জন্য আলোচনার বিষয় / Discussion topic for each Groups:

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1.	বিভিন্ন সময়ের জন্য পানীয় জলের উৎস?/ Source of drinking water for different time periods? 1 SUBMARSIBAL.
2.	পানীয় জল সংগ্রহ করার সময় সামাজিক সমস্যার সম্মুখীন হয়।/Social difficulties faced when collecting drinking water? parday 1 hour NO
3. (a)	পানীয় জল সংগ্রহে দৈনিক কর্মঘণ্টা ব্যয় হয়? / Working hours spent daily in collecting drinking water? parday - 1 hour
(b)	প্রতিদিন পানি সংগ্রহের জন্য পড়াশুনার সময় নষ্ট? / Wastage of study hours for water collection daily? ONe

4.	দূষিত ভূগর্ভস্থ পানি পান করার ফলে স্বাস্থ্যসেবার উপর স্বল্প ও দীর্ঘমেয়াদী প্রভাব? Short and long-term effects on health care by drinking contaminated groundwater? No
5.	আপনার ব্লকে ভূগর্ভস্থ পানির স্তর কমছে নাকি বাড়ছে? Is the groundwater level declining or increasing in your block? AD DOWEN Level
6.	ভূগর্ভস্থ জল রিচার্জের জন্য পছন্দের বিকল্প কী হওয়া উচিত? পুকুর, ম্যানেজড অ্যাকুইফার রিচার্জ বা খনন কূপ, নাকি অন্যদের? / What should be the preferable option for groundwater recharge? Pond, Managed Aquifer Recharge (MAR) or Dug Wells, or others? a) পুকুর (Pond) ☑ b) পরিচালিত অ্যাকুইফার রিচার্জ (Managed Aquifer Recharge) ☐ c) খনন কূপ (Dug Wells) POND ☐ d) অন্যান্য (others) ☐
7.	হলদিয়া ও নন্দীগ্রাম ব্লকের কোন এলাকা পানীয় ও ঘরোয়া জল ব্যবহারের ক্ষেত্রে সবচেয়ে বেশি ঝুঁকিপূর্ণ? / Which area of Haldia and Nandigram blocks are most vulnerable in terms of drinking and domestic water use? a) হলদিয়া/ Haldia Baruldaghighly ☑ b) নন্দীগ্রাম/ Nandigram G.P ☐
8.	দাতারা চলে গেলে কীভাবে এই রিচার্জ সিস্টেমটি টিকিয়ে রাখা যায়। / How can this recharge system be sustained when donors leave? STRUM SYSTEM water
9.	প্রেজেন্টেশনে উপস্থাপিত ডেটা এবং বিশ্লেষণ কি অঞ্চলের জন্য সঠিক? / Are the data and analysis presented in presentations correct for the region? Yes
10.	অন্য কোন তথ্য অনুপস্থিত আছে বা ভূগর্ভস্থ পানি বোঝার জন্য সংগ্রহ করা যেতে পারে? Is there any other data missing or can be procured for groundwater understanding? No

Figure 9: Questionnaire answers of Group 4

6. Reflection of Expert Panel:

Dr. Sudhir Kumar, NIH Roorkee virtually joined as Chief guest and Prof. Pennan Chinnasamy, IIT Mumbai as special guest to the workshop. Both Dr. Sudhir and Prof. Pennan shared their concerned about groundwater issues, groundwater level depletion, recharge and its effect on climate change and vulnerability. Dr. Pennan describes the importance as well as the ultimate goal of this study project.

After the speech of Prof. Pennan Chinnasawamy, Dr. Santosh Pingale, Scientist, Hydrological Investigations Division, NIH, Roorkee presented progress of the GRACERS project and he explained how the groundwater is getting depleted as well as water quality in the Haldia and Nandigram blocks (Figure 10) of the Purba Medinipur district based on the historical groundwater levels. He also showed present groundwater level and groundwater quality variation in the study area based on recent field survey (Figure 11).

Sh. Arindam Ghosh, Director, SWID shared his insights of the groundwater management and had open discussion with participants of the workshop (Figure 12). He emphasized on harvesting rain water during rainy season which could be used for agricultural and drinking water purpose. He also recommended to plant trees to improve environment. He also underlined focuses on management aquifer and how could be recharged effectively during rainy season.

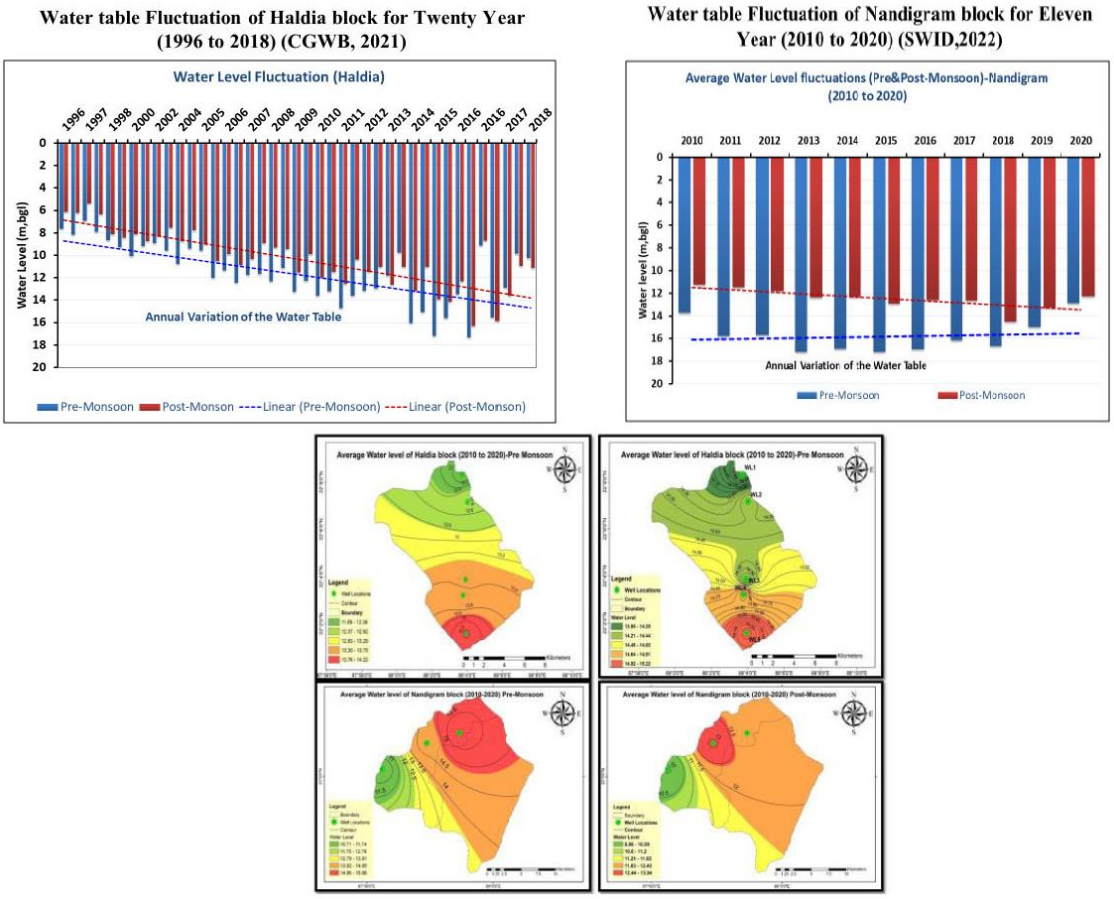
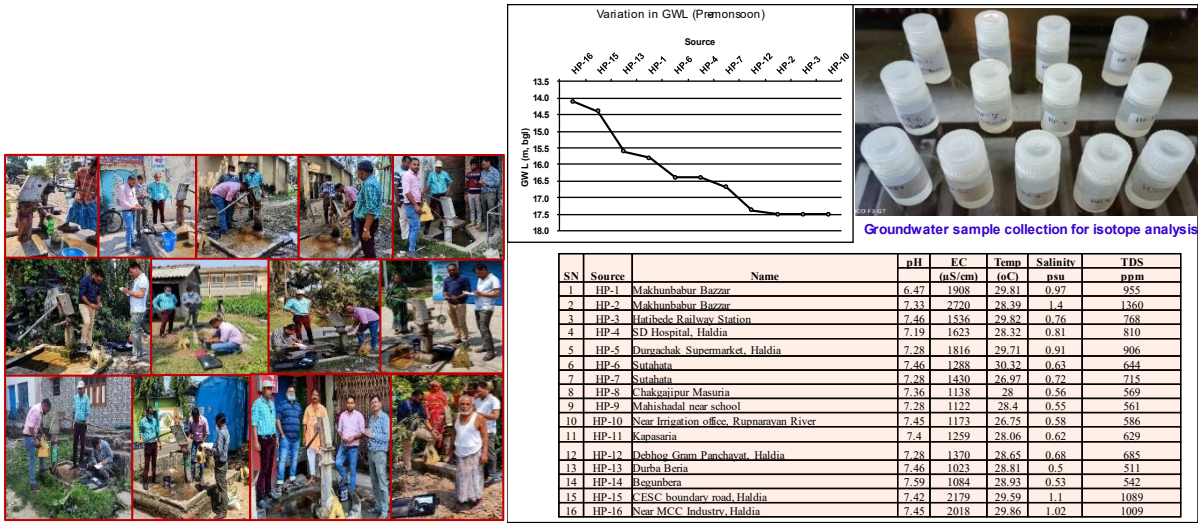


Figure 10: Presentation by Dr. Santosh Pingale, NIH



SN	Source	Name	pH	EC (µS/cm)	Temp (oC)	Salinity psu	TDS ppm
1	HP-1	Makhunbabur Bazzar	6.47	1908	29.81	0.97	955
2	HP-2	Makhunbabur Bazzar	7.33	2720	28.39	1.4	1360
3	HP-3	Hatibede Railway Station	7.46	1536	29.82	0.76	768
4	HP-4	SD Hospital, Haldia	7.19	1623	28.32	0.81	810
5	HP-5	Durgachak Supermarket, Haldia	7.28	1816	29.71	0.91	906
6	HP-6	Sutahata	7.46	1288	30.32	0.63	644
7	HP-7	Sutahata	7.28	1430	26.97	0.72	715
8	HP-8	Chakgajipur Masuria	7.36	1138	28	0.56	569
9	HP-9	Mahishadal near school	7.28	1122	28.4	0.55	561
10	HP-10	Near Irrigation office, Rupnarayan River	7.45	1173	26.75	0.58	586
11	HP-11	Kapasaria	7.4	1259	28.06	0.62	629
12	HP-12	Debhog Gram Panchayat, Haldia	7.28	1370	28.65	0.68	685
13	HP-13	Durba Beria	7.46	1023	28.81	0.5	511
14	HP-14	Begunbera	7.59	1084	28.93	0.53	542
15	HP-15	CESC boundary road, Haldia	7.42	2179	29.59	1.1	1089
16	HP-16	Near MCC Industry, Haldia	7.45	2018	29.86	1.02	1009

Figure 11: Groundwater level measurement & water quality analysis in Haldia block

After that Dr. Santosh Pingale, concluded the workshop with his valuable insights. He mentioned that people of the study area over exploiting groundwater which led to depletion of water levels. He said present groundwater level drastically reduced compared to 1990's groundwater level. He showed concerns, if this trend continues then future generation will face severe shortage of water. He underscored to utilize water wisely and mass people should cooperate with Government agencies such as SWID and BDO office to make their activities

successful. Participant discussion indicated that farmers need to change their cropping pattern now where they have to choose crops which absorb less water. He also recommended to recharge groundwater by utilizing rain water. Some moments of group discussion during the workshop is shown in Figure 12.

7. Table 1: The List of Participants:

Stakeholder Consultation Workshop
on
"Groundwater Rejuvenation As Climate Change Resilience For Marginalized and Gender Sensitive Ganges (GRACERS)"

Venue: Haldia, Purba Medinipur, West Bengal
Date: **March 22, 2022** (Tuesday)

Organised by
National Institute of Hydrology, Roorkee

Registration Form

S.N.	Name	Signature
1.	ARINDAM GHOSH, Director, SWID, GovB	22/3/22
2.	Sanjay Das, BDO, Haldia	Sdu
3.	SUBRATA HALDER, EE(AI) SWID	
4.	SAIBAL SIBA, Senior Geologist SWID.	Siba
5.	SUMANTA DEY, CHEMIST, SWID.	22/03/22
6.	SOMNATH PAHRA, GEOLOGIST, SWID	22/03/2022
7.	Sakina Bibi, Z.P. Member	
8.	Dilip Kr. Bhunia, E.A.	22/03/22
9.	Sanchita Paramanik (Das).	S. P. (Das) 22. 3. 22
10.	Bibyendu Manna	22.3.22
11.	Sumita Mondal (Patra)	S. M. (Patra) 22/03/22
12.	Firoza Bibi	F. Bibi 22/03/22
13.	Basumati Samanta	B. M. Samanta
14.	Bindurata Barik (Mondal)	B. B. Mondal
15.	Rina Kuiry Pradhan Deputy	22/3/22
16.	Shatarupa Jana Malakar.	22.3.22
17.	Shyamali Barman	22.03.22

18.	SK Mahabub Rahaman Secy, Debhog G.P.	[illegible] 22/03/22
19.	Anup Kumar Maiti Secretary, Dealpatia G.P.	[illegible] 22/03/22
20.	Satyendra nath Jana	[illegible] 22/03/22
21.	Barid Baran Manna	[illegible] 22/3/22
22.	Souvik Jash, Secy, Baruttarhingy G.P.	Jash 22/3/22
23.	SK Ajanur Rahaman	Rahaman 22/03/2022
24.	Durga Rani Manna	D.R. Manna 22.3.2022
25.	Ananya Bera, Joint BDO	Bera 22.3.2022
26.	Malay Bhaumik, EE(AI) SWID DIVN-I. Midnp.	[illegible]
27.	Narayan Singh JE(RWS)	NSingh 22.03.22
28.	Subrata Bhunia (Baruttarhingly G.P.)	S. Bhunia 22.03.22
29.	SK GHAB ALI	SK GH[illegible]
30.	[illegible]	[illegible]
31.	Sumita Kar Khutia	Khutia
32.	Subu Bera	SBera
33.	Alok Ranjan Das.	Das.
34.	Swadhin Manna.	SManna.
35.	Uma Pramanik Retd	Uramanik
36.	Dinesh Chandra Hajra	DHajra.
37.	Pulak Kumar Hazra.	PHazra.
38.	Srikanta Maity.	Sanchalak
39.	Namita Das Giri	NGiri
40.	Subrata Kum Hajra	Hajra
41.	Shyamal Sen	[illegible]
42.	Sebasenkere Das.	[illegible]
43.	Bhakti Prasad Manna	BManna
44.	Sumit Kant, Project Associate, NIH	[illegible]
45.	Jay Ghosh Al	[illegible]
46.	UDDIPTA KUMAR DUTTA	[illegible]
47.	Mayuri Sharma	mSharma
48.	Ashish Ranjan Sen	ASen
49.	Gautam Basu	GBasu.
50.	Dilip Kedia	[illegible]

8. Glimpses from the Workshop:

Figure 12: Some moments of open group discussion during the workshop

9. Project Brief shared with Invitation Letter

Workshop on
"Groundwater Rejuvenation as Climate Change Resilience for marginalized and gender sensitive Ganges (GRACERS)"

Dear sir/madam,

It is our great pleasure to inform you that National Institute of Hydrology (NIH) Roorkee along with the Indian Institute of Technology Bombay (IITB) is conducting the study project *"Groundwater Rejuvenation Resilience as Climate Change for marginalized and gender-sensitive Ganges (GRACERS)"*. The aim of this project is to produce feasibility maps for decentralized/distributed groundwater recharge in the Ganga basin. The project finding has been sensitized to the groundwater issue and proposed sites and methods to increase groundwater recharge. The top academic and Research institutes i.e., IIT Bombay & IHE Delft and government agencies National Institute of Hydrology (NIH), India & IWM, Bangladesh are involved with this project. This two-year project is funded by DUPC and UN-IHE, Netherlands. In the meanwhile, NIH has prepared a draft report including vulnerability maps for groundwater stressed areas and has a hotspot for decentralized groundwater recharge.

A workshop will be held on 22nd March 2022 from 9:30 AM to 2:00 PM at Haldia, West Bengal to exchange the study finding and to gather feedbacks, comments and suggestions from the concerned Stakeholders, Organisations, Local Authorities, Experts and Marginalized peoples.

Dr. Sudhir Kumar, Scientist G & Head, HI Division, NIH, and Sh. Arindam Ghosh, Director, State Water Investigation Directorate (SWID), West Bengal has kindly consented to grace the Workshop as the Chief Guest. Sh. Subrata Haldar, Executive Engineer, SWID and Prof. Pennan Chinnasamy, CTARA, IITB and GRACERS Project Director, India have kindly given their consent to attend the workshop as Special Guests.

The workshop will be presided over by Sh. Sanjay Das, Block Development Officer (BDO), Haldia Development Block and Shri. Subrata Hazra, Sabhapati, Haldia Panchayat Samity.

You are cordially invited and requested to attend (or nominate a suitable representative for the workshop.

Santosh Pingale,
Scientist-C, NIH Roorkee

Stakeholder's Consultation Workshop

on

"Groundwater Rejuvenation As Climate Change Resilience For Marginalized and Gender Sensitive Ganges (GRACERS)"

Venue: Haldia, Purba Medinipur, West Bengal

Date: **March 22, 2022 (Tuesday)**

Groups:

Group 1: Representatives of Haldia block
Group 2: Representatives of Haldia Panchayat Samity
Group 3: Implementing agencies & Government Officials
Group 4: Vulnerable Groups & Users

PROGRAMME SCHEDULE

10.15-11.00 AM	Registration
11.00-11.05 AM	Welcome Address by **Dr. Santosh Pingale**, Scientist-C, NIH Roorkee
11.05-11.10 AM	Inaugural Address by the Chief Guest: **Dr. Sudhir Kumar**, Scientist-G & Head, HI Division, NIH Roorkee
11.10-11.15 AM	Overview of the Project by **Dr. Pennan Chinnasamy**, IIT Bombay
11.15-11.25 AM	Progress of the Project by **Dr. Santosh Pingale**, NIH Roorkee
11.25-11.35 AM	Address by the Guest of Honour: **Shri. Arindam Ghosh**, Director, State Water Investigation Directorate, Govt. of West Bengal
11.35-11.40 AM	Address by the Guest of Honour: **Shri. Sanjay Das**, Block Development Officer, Haldia Development Block, Govt. of West Bengal
11.40 -11.45 AM	**TEA BREAK**
11.45-12.30 PM	**Discussion topics for each Groups**
	1. Source of drinking water for different time periods. 2. Social difficulties faced when collecting drinking water. 3. (a) Working hours spent daily in collecting drinking water? (b) Wastage of study hours for water collection daily? 4. Short and long-term effects on health care by drinking contaminated groundwater. 5. Is the groundwater level declining or increasing in your block? 6. Water should be the preferable option for groundwater recharge? Pond, Managed Aquifer Recharge (MAR) or Dug Wells, or others? 7. Which area of Haldia and Nandigram blocks are most vulnerable in terms of drinking and domestic water use? 8. How can this recharge system be sustained when donors leave? 9. Are the data and analysis presented in presentations correct for the region? 10. Is there any other data missing or can be procured for groundwater understanding?
12.30-12.50 PM	**Panel Discussion**
	Discussion and reflection of panel will be based on vulnerability and risk assessment, adaptation & resilience, Engineered interventions and groundwater recharge networks, community participation and solution for groundwater management in the study region.
12.50-12.55 PM	**Way Forward and Recommendations**
12.55-1.00 PM	**Closing and Vote of Thanks**

10. Recommendations

Based on the workshop deliberations by the experts, field survey, findings of the project and other factors analysis, following recommendations are provided:

a) People suffered by drinking contaminated water due to problem of Arsenic, Fluoride, and Salinity. Therefore, it is recommended to construct more rainwater harvesting structures to recharge groundwater as well as store rainwater through ponds to meets household & domestic needs.
b) In case of availability of adequate lands, construction of the pond is a good option. It can be used as recharge pond as well as will serve as a reservoir to meet out household & domestic needs.
c) Rejuvenation of the existing public & private ponds/water harvesting structures are recommended.
d) Submersible pumps installation is good solution to reduce water scarcity. But when well defined shallow aquifer are not available, dug well can be installed.
e) There is a need to focus on groundwater management issues and regular monitoring of groundwater levels for taking appropriate interventions.

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