

An overview of Mechanized Irrigation Innovation Project (MIIP) in Sarlahi and Rautahat district in Nepal

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ABSTRACT

Even though Nepal's Terai region has a lot of groundwater, it's still struggling with water shortages for farming and daily use because of poor planning and management. To solve this, the Department of Water Resources and Irrigation (DWRI) is launching the Mechanized Irrigation Innovation Project (MIIP). This project, backed by the Asian Development Bank (ADB), is designed to bring a steady supply of water to 40,000 hectares of farmland in the Sarlahi and Rautahat districts of Madhesh Province. In the first phase, the project will install 500 deep tube wells to water 22,400 hectares of land. A major part of this plan is setting up a large network of tube wells with their own power supply. Farmers will get water using a prepaid smart card, and about 900 km of buried pipes will carry the water directly to their fields. The project also helps farmers adapt to climate change by offering training on modern irrigation methods and how to grow different crops. The DWRI will handle the construction, and once that's done, the Irrigation Management Company (IMC) will take over the day-to-day operations and maintenance for ten years. This project is a big step towards modernizing Nepal's irrigation system and ensuring a more secure future for its farmers.

Keywords: *Irrigation Project; groundwater; Madhesh Province*

INTRODUCTION

The Terai region of Nepal is known for its abundant groundwater resources with the Bhabar zone along the foothills of the Siwalik range- characterized by coarser colluvium and alluvial fan deposit where sediment size decreases gradually towards south is considered as the main recharge zone for the aquifers in Terai (Pathak 2017). Despite the availability of a large amount of groundwater, only about 22% of the dynamic recharge is currently being utilized (Shrestha et al. 2018). Madhesh Province, in particular possesses significant groundwater potential through both shallow and deep aquifers. Due to inadequate planning, management, and implementation, this region continues to experience severe water insufficiency for irrigation and drinking despite these enormous groundwater reserves. The Mechanized Irrigation Innovation Project (MIIP) is being carried out by the Department of Water Resources and Irrigation (DWRI) in order to address the issue of water scarcity for irrigation. The project is designed to make a significant contribution to agricultural development in Madhesh Province by providing a reliable and sustainable irrigation system across 40,000 hectares of land located in the Rautahat and Sarlahi districts. Agriculture in this region is predominantly rain-fed and therefore highly vulnerable to erratic monsoon patterns, prolonged dry spells, and the growing impacts of climate change. Crops can be grown all year round rather than only during the rainy season if there is consistent access to water. In addition to staple crops like wheat and rice, farmers will be able to plant cash crops that generate higher profits as well as fruits, vegetables, and other crops. This change will increase food security, lessen the need for seasonal migration, and allow families to make investments in the health and education of their children. Beyond farming, the project gives them

stability and self-worth because they know their efforts will be rewarded. To put it briefly, irrigation is more than just water for the fields; it is a symbol of hope for a safer and better future for communities throughout Madhesh Province.

PROJECT IDENTIFICATION AND OVERVIEW

The project was developed with financial support from the Asian Development Bank (ADB) under the Water Resources Project Preparatory Facility (WRPPF). A feasibility study conducted between January 2018 and November 2019 initially proposed the construction of 1,000 deep tube wells to irrigate 40,000 hectares. Following discussions during an ADB mission in November 2019, a phased implementation approach was adopted. The project will construct 500 deep tube wells to irrigate 22,400 hectares of land in its first phase (Fig. 1).

Table 1 (Rautahat) and Table 2 (Sarlahi) present the distribution of tube wells and their corresponding command areas across municipalities (Palikas) and wards. The tables show the number of tube wells installed in each ward, the total for each municipality, and the area of land (in hectares) brought under irrigation by those wells.

In Rautahat District, a total of 273 tube wells serve an irrigated command area of 12,019 hectares. The coverage varies across Palikas: Maulapur (56 tube wells, 2,482 ha) and Baudhimai (55 tube wells, 2,424 ha) have the largest irrigated areas, while Garuda has the smallest with only 4 tube wells covering 171 hectares. Other Palikas such as Madhav Narayan, Paroha, and Dewahi contribute substantially, each exceeding 1,000 hectares of command area.

In Sarlahi District, the total stands at 227 tube wells irrigating

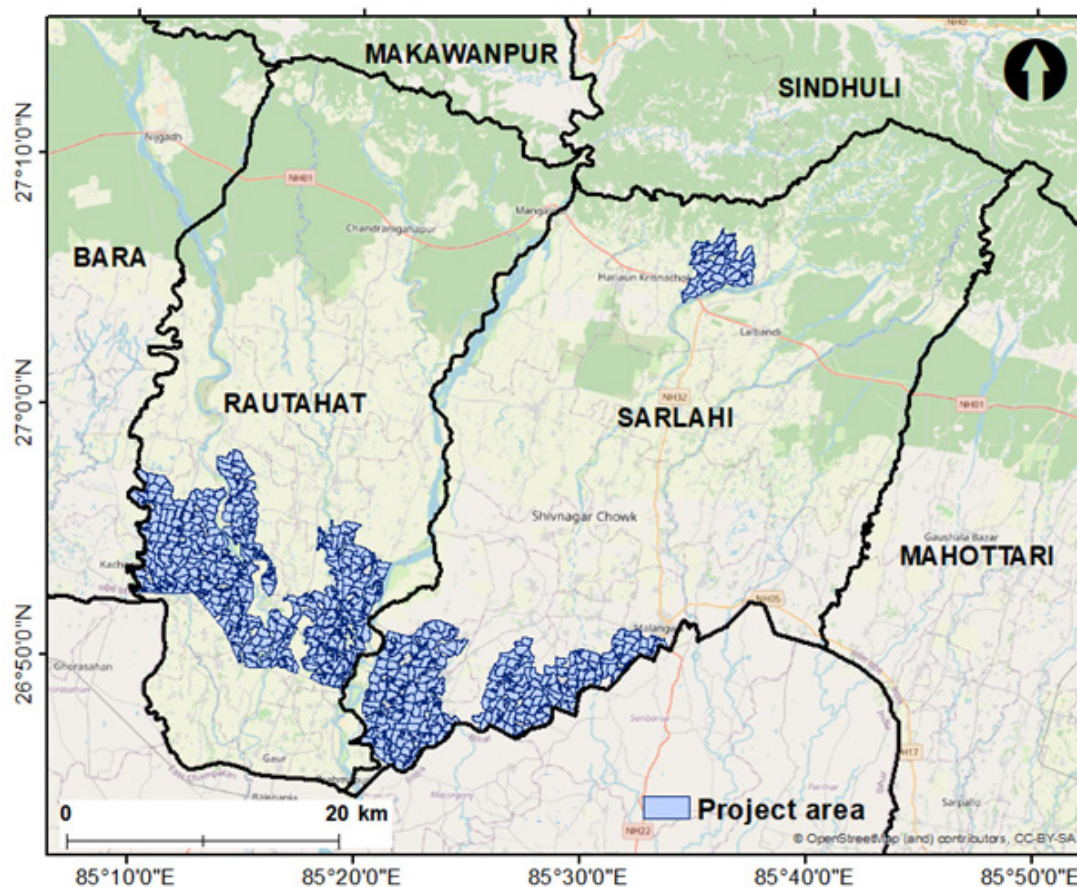


Fig. 1: Location of MIP command area (First phase).

10,673 hectares. Balara Municipality leads with 64 tube wells and the largest command area (3,097 ha), followed by Bishnu (43 tube wells, 1,936 ha). Smaller Palikas like Kaudena (7 tube wells, 320 ha) and Malangawa (22 tube wells, 1,025 ha) have limited coverage compared to larger municipalities.

Altogether, both districts account for 500 tube wells, irrigating a combined 22,692 hectares of agricultural land. This distribution highlights how tube wells are strengthening irrigation facilities, though some Palikas remain comparatively underserved.

Table 1: Location of the MIP (Rautahat District)

Municipality	Ward No									Total	Area (ha)
	1	2	3	4	5	6	7	8	9		
Baudhimal	8	6	6	7	5	11	4	4	4	55	2,424
Dewahi			4	5	14	6				29	1,336
Durgabhagwati	5	5	6	7	3					26	1,182
Garuda	4									4	171
Madhav Narayan				12	6	10	8	4		40	1,702
Maulapur			10	4	6	9	10	9	8	56	2,482
Paroha	2	2	11	7		6				28	1,208
Rajpur		9	5							14	623
Yemunamai	9	3	4	5						20	836
Grand Total	28	25	46	47	34	42	22	17	12	273	12,019

Table 2: Location of the MIIP (Sarlahi District)

Municipality	Ward No												Total	Area (ha)
	1	2	3	4	5	6	7	8	9	10	11	12		
Balara	4	6	6	7	7	4		4	11	6	9		64	3,097
Bishnu	5	8	3	7	4	16							43	1,936
Godaita	4	11	9			1						1	26	1,279
Hariwan	9		11	10									30	1,393
Kaudena							7						7	320
Malangawa	3	2			4	12	1						22	1,025
Ramnagar	11	7	1	8			8						35	1,623
Grand Total	36	34	30	32	15	33	16	4	11	6	9	1	227	10,673

The DWRI will play a central role in guiding the project through its construction phase. Acting as the lead authority, DWRI will be responsible for ensuring that all works are carried out to technical standards, monitoring progress, and addressing challenges that may arise along the way. Once the construction is complete, responsibility will shift to the Irrigation Management Company (IMC), which will take charge of the system’s day-to-day operation and long-term upkeep. This transition ensures that the infrastructure does not simply stop at being built but continues to serve farmers and communities reliably over time.

The project has been structured under a Design-Build-Operate (DBO) contract model, which combines construction, operation, and maintenance into a single framework. This approach is intended to create accountability, as the same entity that builds the system will also be responsible for ensuring its functionality over the next decade. The construction itself is expected to be completed within four years, after which the IMC will manage the system for an additional 10 years under the operation and maintenance (O&M) period. This arrangement is designed to deliver not only a functioning irrigation system but also a sustainable service that farmers can depend on year after year. A key feature of the project is the establishment of a large-scale tube well network supported by dedicated electricity distribution systems. Farmers will access irrigation water through a prepaid smart card system, ensuring efficient and demand-based water delivery. Additionally, approximately 900 km of buried pressure pipes will be installed to transport water directly to agricultural fields. The project also incorporates climate-resilient farming support, including crop diversification and training in advanced irrigation techniques. The pilot project constructed in Paroha, Rautahat is currently operating very well (Fig. 2).



Fig. 2: Pilot project constructed in Paroha, Rautahat (Photo source: DWRI and ADB).

SIGNIFICANCE OF THE PROJECT

Agriculture plays a vital role in Nepal's economy, contributing 26% of the GDP and employing approximately 80% of the rural workforce. However, irrigation limitations and the growing impacts of climate change pose significant threats to food security. Traditional canal-based irrigation systems primarily support monsoon-season rice cultivation, leaving dry-season farming underserved. The MIIP addresses these challenges by promoting sustainable groundwater-based mechanized irrigation as a reliable alternative.

One of the major challenges in Nepal's irrigation sector is the inefficiency in operation and maintenance. Existing tube wells operate for an average of only 208 hours per year, highlighting systemic management issues. Additionally, Water Users' Associations (WUAs) often struggle to maintain irrigation infrastructure effectively. To ensure long-term sustainability, the MIIP introduces a prepaid smart card system, guaranteeing full fee collection and reducing financial dependency on external funding.

PROJECT OUTPUTS

The project is structured around two primary outputs. The first focuses on establishing sustainable groundwater irrigation systems, including the construction of 500 tube wells equipped with variable-speed pumps, dedicated low-voltage power networks, smart card-operated telemetry systems, and an extensive pressurized pipe distribution network.

The second output emphasizes climate-resilient agricultural practices. This includes promoting high-value crop cultivation, improving market linkages, and providing training in efficient

irrigation methods such as micro-irrigation. The project also aims to enhance productivity for staple crops like paddy and wheat while ensuring inclusive participation of women and marginalized communities in decision-making processes.

CONCLUSIONS

The Mechanized Irrigation Innovation Project represents a significant step toward modernizing Nepal's irrigation infrastructure. By leveraging groundwater resources, integrating advanced technology, and promoting sustainable farming practices, the project aims to enhance agricultural productivity, support rural livelihoods, and strengthen food security in Madhesh Province. Through efficient management and climate adaptation strategies, the MIIP sets a precedent for future irrigation development in Nepal.

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