भारत सरकार
जल शक्ति मंत्रालय
(जल संसाधन, नदी विकास और गंगा संरक्षण विभाग)
केन–बेतवा लिंक परियोजना प्राधिकरण

Government of India
Ministry of Jal Shakti
(Department of WR, RD and GR)
**Ken-Betwa Link Project Authority**

(By Email Only)

क्रमांक:-के.बे.लि.परि.प्राधि./खण्ड/झांसी/टी-30(TAG)/828-848 दिनांक:
No:-KBLPA/Div./JHANSI/T-30(TAG)/ Date: 19.08.2025

**Sub:- Minutes of 13th Meeting of Technical Advisory Group of Ken Betwa Link Project Authority on 13.08.2025 in online mode.**

The 13th Meeting of Technical Advisory Group of Ken Betwa Link Project Authority was held on 13.08.2025 in online mode under the chairmanship of Shri D.P. Bhargava, Former Director (Technical), NHPC, Faridabad.

Minutes of the meeting, duly approved by the Chairman (TAG-KBLPA) is enclosed for kind information and further necessary action by all concerned.

19/08/25

(T. M. Tripathi)
ACEO (Canal) &
Member-Secretary

**To: All the Members of TAG of KBLPA**

1. Shri D.P. Bhargava, Former Director (Technical), NHPC, Faridabad.
2. Shri P.K. Saxena, Former Commissioner (Indus), DoWR, RD&GR.
3. Shri Vijai Saran, Former Chief Engineer, CWC.
4. Shri V.K. Niranjan, Former HOD & E-in-C, I&WRD, UP.
5. Shri G.P. Soni, Former Chief Engineer, WRD, MP.
6. Chief Engineer, Designs (NW&S), CWC, New Delhi.
7. Director(CSMRS) or nominee.
8. Director (Hydrology), CWC, New Delhi.
9. Additional CEO (Head Works), KBLPA, Bhopal.
10. Additional CEO (HQ/P), KBLPA, Lucknow.
11. Additional CEO (E&M), KBLPA, Bhopal.
12. Chief Engineer (Designs)/BODHI, WRD, MP.
13. Chief Engineer (Designs), I&WRD, UP.

**Copy for kind information to:-**

1. The Additional Chief Secretary, WRD, Govt. of MP, Bhopal.
2. The Principal Secretary, I&WRD, Govt. of UP, Lucknow.
3. The Member, D&R, CWC, New Delhi.

**Special Invitee :-**

1. Chief Executive Officer, KBLPA, Bhopal.
2. Director General, NWDA, New Delhi.
3. Engineer-in-Chief, WRD, Govt. of MP, Bhopal.
4. Engineer-in-Chief (Projects), I&WRD, Govt. of UP, Lucknow.
5. ACEO (Construction), KBLP, I&WRD, Jhansi.

**Minutes of 13th Meeting of Technical Advisory Group of Ken-Betwa Link Project Authority held on 13.08.2025 in online mode**

The 13th meeting of the Technical Advisory Group of Ken-Betwa Link Project Authority (TAG-KBLPA) was held on 13.08.2025 in online mode under the Chairmanship of Shri D. P. Bhargava, Former Director (Technical), NHPC. The list of participants is attached as **Annexure-I**.

At the outset, the Chairman welcomed all the participants and advised ACEO (Canal), KBLPA to present the two Agenda Items. The details of the agenda items and discussions/decisions taken are as under:

**13.1 Agenda Point -1: Review of the Alternate alignment (Tunnel + Canal Combination) of Ken-Betwa Link Canal from R.D. 116150 m to R.D. 125622 m in village Ramnagar as proposed in 11th TAG.**

1. The Member Secretary commenced the proceedings with opening remarks, expressing thanks to all participants for their presence. He further outlined the chronology of events relating to the proposed realignment of link canal in the specific stretches and actions taken by KBLPA on the matter. The complete text of his remarks is attached at **Annexure-II.**
2. It was informed that in the 11th TAG meeting held on 9&10 May 2025, the proposal of Govt of MP for alignment of canal in all the reaches was accepted except for the reach RD 116150m to 125622m (village Ramnagar). The TAG recommended that as the proposed alignment has multiple sharp bends and involves an additional length of 603 meters thus the option of taking water through the tunnel & canal combination to the extent feasible may be explored which will reduce the length and minimize the bends in the water carrier, reduce the losses and thus will be more efficient. The new proposed alternative comprised of a Tunnel (1.5km) and open canal (2.75km).
3. The KBLPA, Jhansi had forwarded the proposed modified alignment of the canal with the recommendations of the TAG to CWC for examination and approval vide email dt 19.6.2025. CWC suggested to carry out the techno-economic comparison of the two alternatives discussed in the TAG with respect to the cost, time of construction, cost of land acquisition, etc. to take an informed decision on the preferred alternative. Accordingly, the matter was deliberated in the 12 TAG meeting held on 28.7.2025 wherein it was decided that KBLPA will carry out desk study with the available data for cost comparison of the two alternatives i.e. Tunnel of length 1.5 km + Canal of length 2.75 km vis-à-vis Canal of length 5.89 km; and will prepare L-section (geological)and designs of the proposed tunnel alignment. It will submit the study report along with the L- section of the tunnel alignment at the earliest.
4. In compliance of the above decision, the Member Secretary apprised that the Desk Study report, completed on the basis of available data, has been circulated to all members of the TAG along with TAG-KBLPA meeting notice on 07.08.2025. The same is placed at **Annexure-III**.
5. Subsequently, to expedite the proceedings, on 08.08.2025 the Chairman, TAG requested all the members to examine the study report and send their opinion for the preferred proposal-1(Tunnel+ Canal combination) or Proposal-2 (Fully open canal) by 11.08.2025.
6. The Key points of the aforesaid study were presented during the meeting by the Member Secretary.

7. The Chairman observed that the suggestions/comments from the Chief Engineer, Designs (NW&S), CWC comprehensively addressed all relevant aspects of the study and concurred with the views expressed therein. The Chief Engineer, CWC further suggested that the views of all TAG-KBLPA members be formally presented and considered.

8. The Member Secretary then presented the views received from TAG-KBLPA members on the study report for consideration by TAG. The copy of views of the members received via email are attached at **Annexure-IV.**

9. After deliberations on the views of the TAG members in the meeting, consensus on the following points emerged:

   a) Hydraulically it is feasible to convey the required discharge through a single large-sized tunnel or through twin smaller-sized tunnels. Both these options shall be cost-intensive and time-consuming from a construction perspective.

   b) The geology of the strata through which the tunnel is proposed to traverse suggests challenging excavation conditions and potential stability issues during construction.

   c) For construction of tunnel, additional geo-technical investigations would be required, which would further delay the project works.

   d) The cost comparison submitted by KBLPA for both the proposals clearly indicated the tunnel option to be much costlier.

   e) The open canal alignment had the operational advantages like easier maintenance, direct accessibility for inspections, greater flexibility for future upgrades, lower long-term maintenance cost, etc.

10. All the members preferred the original open canal alignment over the earlier proposed combination of tunnel & canal alignment.

11. Finally, the Chairman, TAG-KBLPA accepted the recommendation of the members for adopting the open canal and advised that further action be taken accordingly.

**13.2 Agenda Iem-2: Discussion on the raising the Pond level of Banda Barrage.**

Banda barrage envisages to provide water for drinking purpose and facilitate 13000 hectares of irrigation in Banda district. For which a total of 100 MCM (Drinking water- 40 MCM, Irrigation- 60 MCM) water is required.

For the first time the I&WRD, Govt. of Uttar Pradesh presented the case to TAG of KBLPA to consider the raising of the Pond Level form RL 104m to 107 m highlighting the various water requirement needs. The details regarding the villages impacted due to submergence were also presented. The details of Barrage storage capacity at various Pond Level were also presented. Copy of the presentation on Banda Barrage is attached as **Annexure V**.

The key points submitted by I&WRD, Govt. of Uttar Pradesh for discussion are as follows:

1. The location of Banda Barrage on Ken River (UP) was finalized at RD 64.00 in May 2022 after joint visit to the site on 20.05.2022. Due to railway bridge upstream, the location of Barrage was subsequently changed to RD 66.88 m after joint visit on 06.05.2024.

Subsequently, in detailed survey, the total storage capacity of Banda Barrage was assessed at 55.214 MCM at RL 104m, which is approximately half of the previously envisaged capacity of 107 MCM. Therefore, the use of barrage will only be limited to the supply of drinking water and no irrigation facility would be available to the farmers. Thus, the state of Uttar Pradesh will not be fully benefited by Ken-Betwa Link Project.

It was also informed that tentative storage capacity of the proposed Banda Barrage at the new location is assessed at 85 MCM at RL107.00 m.

I&WRD, Govt. of Uttar Pradesh submitted that on increase of the pond levels from 104m to 107m the water spread area shall be confined within the banks of river Ken and its contributing nalas.

2. The location of the State of Madhya Pradesh is at some distance from the barrage site; however, at the proposed pond level (107 m), submergence of six villages within the territory of the Government of Madhya Pradesh would occur.

3. During discussion, Chief Engineer, WRD, Govt. of Madhya Pradesh, Sagar requested details of submergence area and comparison with submergence area in the earlier proposal.

4. Shri Vijai Saran, Member TAG, suggested that study to determine the backwater levels at the various ponds level should be taken up to determine the extent of the fetch and submergence area using HEC-RAS.

5. Shri V. K. Niranjan, Member, TAG, who has a vast exposure of Bundelkhand region water resource developments, observed that the water requirement projected in the proposal appears to be on the higher side. He recommended that the water requirement be carefully reassessed and incorporated into the proposal after due diligence. He emphasized that several drinking water schemes are operational in the region, and therefore, the water demand should be re-examined in coordination with UP Jal Nigam and other relevant agencies, as appropriate. He further suggested that the Culturable Command Area (CCA) should also be reviewed, considering the presence of functional pump canal systems currently serving the region's irrigation needs.

6. Chief Engineer, Designs (NW&S), CWC opined that the pond level of the barrage is normally finalized by the designers in consultation with the project authority considering the design requirements, storage planned, regulation of barrage for drinking water, to meet irrigation requirement, etc. and the State Government's consent for the area coming under submergence. Once the detailed proposal for various alternatives is finalized, the same should be brought to the TAG for deliberations. He also emphasized on expediting the authenticate data collection in current scenario to fix the pond level which has already been delayed since May 2022 so as to complete the DPR draft at the earliest.

7. After the discussions, TAG recommended that:

   - The water requirement should be reassessed. The details/basis of the same should be included in the proposal.
   - The backwater study for different pond levels shall be undertaken using the HEC–RAS software.

- The submergence area details and factual figures should be worked out and proposal should be shared with the Govt. of Madhya Pradesh for their view prior to placing the matter before the TAG.
- Various feasible alternatives (at different Pond level) shall be prepared and compared with their pros & cons, in consultation with the designers, all stake holders and then presented to TAG.

The meeting ended with vote of thanks to Chair.

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**Annexure-I**

# List of participants in 13th Meeting of Technical Advisory Group of Ken-Betwa Link Project Authority on 13.08.2025 online mode

**TAG Members**

| | | | |
|---|---|---|---|
| 1. | Shri D.P. Bhargava, Former Director (Technical) NHPC, Faridabad | - | Chairman |
| 2. | Shri P.K. Saxena, Former Commissioner (Indus), DoWR, RD&GR | | Member |
| 3. | Shri Vijai Saran, Former Chief Engineer, CWC. | | Member |
| 4. | Shri V.K. Niranjan, Former HOD & E-in-C, I&WRD, UP | | Member |
| 5. | Shri Gyan Prakash Soni, Former Chief Engineer, WRD, MP | - | Member |
| 6. | Shri Sarbjit Singh Bakhshi, Chief Engineer, Design (NW&S), CWC | - | Member |
| 7. | Dr. R. Chitra, Director, CSMRS, New Delhi | - | Member |
| 8. | Shri Raj Kumar Mishra, ACEO(HW), KBLPA, Bhopal. | | Member |
| 9. | Shri Shiva Prakash, ACEO(HQ/P), KBLPA, Lucknow | - | Member |
| 10. | Shri Prabhat Kumar Dubey, Chief Engineer (Design), I & WRD, UP, Lucknow | - | Member |
| 11. | Shri T.M. Tripathi, ACEO(Canal), KBLPA, Jhansi | - | Member Secretary |

**Special Invitees**

1. Shri Baleshwar Thakur, Director General, NWDA, New Delhi
2. Shri P.K. Dixit, CEO, KBLPA, Bhopal
3. Shri Devesh Shukla, ACEO(Cons.), KBLP, I&WRD, UP

**Other Participants**

1. Shri Neeraj Manglik, Chief Engineer (HQ), NWDA, New Delhi.
2. Shri R P S Kanwar, Chief Engineer, Dhasan-Ken Basin, WRD, Sagar, MP
3. Dr. Manish Gupta, Scientist-E, CSMRS, New Delhi
4. Shri Naveen Gaur, SE, KBLC, WRD, UP
5. Shri Ashish Singh Kushwah, Executive Engineer, KBLPA, Jhansi
6. Shri Nalin Vardhan, Executive Engineer, KBLCCD-1, I&WRD, UP
7. Shri Mohsin Hasan, Executive Engineer, KBLC, WRD, Baldeogarh, MP
8. Shri Amit Tiwari, Junior Engineer, KBLPA, Jhansi

## Remarks of Member-Secretary, TAG-KBLPA

The tender for link canal was prepared on the basis of DPR- 2010 & MoA, KBLPA most of the things have deliberated in detail & firmed up by experts.

Meanwhile, the draft estimate for the subject works was prepared in December 2024, considering the original alignment. However, in a review meeting held on 21.11.2024 by JS (RD&PP), the stakeholder officers requested a change in alignment to KBLPA. Accordingly, JS (RD&PP) directed the officers of GoMP and GoUP to furnish their proposals expeditiously. As the proposals were still not submitted, the matter was discussed in a meeting at the Ministry of Jal Shakti (MoJS) on 21.02.2025, wherein it was directed that the Government of Uttar Pradesh (GoUP) and the Government of Madhya Pradesh (GoMP) submit their proposals within 10 days.

The final proposal from GoUP was received on 27.03.2025 and from GoMP on 21.04.2025.

On receipt of the proposals, the same were examined expeditiously by KBLPA & submitted to CWC on 18.06.2025. However, in the portion of Ramnagar which is approximately 5.9 Km stretch out of 218 km which is being considered in this TAG meeting whether canal as proposed by GoMP should be constructed or new alternative of tunnel be considered. If canal is considered, the process of tendering can be done immediately to meet the target of completing the canal to match the reservoir filling of Daudhan Dam. However, if tunnel is adopted detailed geological and topographical investigations are needed in this area for which outside agencies would be required who will take their own time.

Further, it will introduce an element of uncertainty in design, construction and operation, since the area comprises fragmented granite.

The tunnel option may not save as much money on land acquisition as initially expected. Even with twin tunnels, we would still need to acquire about 35 meters of land width, so the cost difference won't be that significant. Any small savings we might get from reduced land acquisition will likely be cancelled out by the much higher costs of building the tunnel itself.

If we decide to go with the tunnel option, we will need at least six more months for detailed investigation before we can even start the tender process. This delay might also require us to get a fresh technical approval, which adds more uncertainty to the project timeline. The tunnel construction will require specialized experts for the 1.5-kilometer section, which will make the project much more expensive and complicated.

Overall delay in this decision or adoption of tunnel will delay the completion of link canal. While the work of dam construction is already undergoing on full pace, the canal completion is also required to be completed by December 2030 to meet overall goals of the project.

Looking at all these factors, the tunnel option doesn't offer enough benefits to justify changing our current plans. The small potential savings in land costs are outweighed by higher construction costs, longer project delays, the need for specialized contractors, and possible approval delays.

In case of delay of construction of canal, the public of Bundelkhand would be deprived of water in spite of water storage in Bundelkhand which would not be appreciated by MoJS & Stakeholders.

KBLPA officers supported by PMC has seen the proposals & found it satisfactory.

As per TAG instructions, the desktop study was completed quickly based on existing geological data from Central Ground Water Board, Ministry of Water Resources & utilizing the service of PMC for tunnel design and cost comparisons.

Alternative of Open Channel is recommended in 12$^{th}$ TAG meeting for the acceptance.

Annexure-III


भारत सरकार/Government of India
जल शक्ति मंत्रालय/Ministry of Jal Shakti
जल संसाधन नदी विकास और गंगा संरक्षण विभाग
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Ken-Betwa Link Project Authority

# PROPOSAL FOR THE TECHNICAL ADVISORY GROUP FOR TUNNEL BETWEEN RD 116.1 KM AND RD 125.7 KM OF KEN-BETWA LINK CANAL

**JHANSI**

**AUGUST**

**2025**

**PROPOSAL FOR THE TECHNICAL ADVISORY GROUP FOR**

**TUNNEL BETWEEN RD 116.1 KM AND RD 125.7 KM OF KEN-BETWA LINK CANAL**

## 1. Summary

This proposal presents a comprehensive analysis of the feasibility of constructing a tunnel section for the Ken-Betwa Link Canal between RD 116.1 km and RD 125.7 km. Following recommendations from the Technical Advisory Group (TAG), techno-economic comparison has been conducted to evaluate the technical and financial viability of this alternative alignment approach.

## 2. Project Background

i. The Ken-Betwa Link Canal represents a major water transfer infrastructure project, functioning primarily as a contour canal with limited ridge canal sections. Originating from the desilting basin downstream of the exit portal of the Upper Level tunnel, the canal spans 218.695 km before out falling into the Barwa Sagar reservoir.

ii. During the 11th meeting of the TAG held on May 9-10, 2025, in Jhansi, concerns were raised regarding the proposed canal alignment in the reach between RD 116.1 km and RD 125.7 KM. The TAG observed that the current alignment incorporated multiple bends and required an additional construction length. More importantly, the group identified a potential straight route between coordinates E-323029.938 N-2759607.085 and E-319454.246 N-2760476.974, which could reduce the alignment length, however requiring approximately 1.5 km of tunnel construction.

iii. The TAG emphasized that implementing a tunnel-canal combination along this route would reduce overall length, minimize hydraulic losses through bend elimination, and significantly improve operational efficiency. This recommendation prompted the present assessment based on site visits and interactions.

## 3. Site Assessment and TAG Deliberations

i. Following TAG's initial recommendations, a site visit was conducted on June 7, 2025. The inspection team comprised the CEO (KBLPA), ACEO (Canal) and officers from the WRD, GoMP and KBLPA officials. The visit focused on tunnel construction feasibility near Ramnagar/Charee village in Tikamgarh District. The site visit evaluation observations and indicated potential technical and financial challenges associated with choosing tunnel construction in place of open canal.

ii. These findings were subsequently presented during the 12th meeting of the TAG, wherein critical project timeline concerns were discussed. The TAG agreed that conducting onsite physical comprehensive geological investigations would necessitate significant time

investment, potentially delaying the land acquisition & tendering process and subsequent activities in implementation phases. Given that construction activities at Daudhan Dam had already commenced in March 2023, any further delays in finalizing the canal alignment would adversely impact the overall project schedule of canal to deliver the water at Barua Sagar.

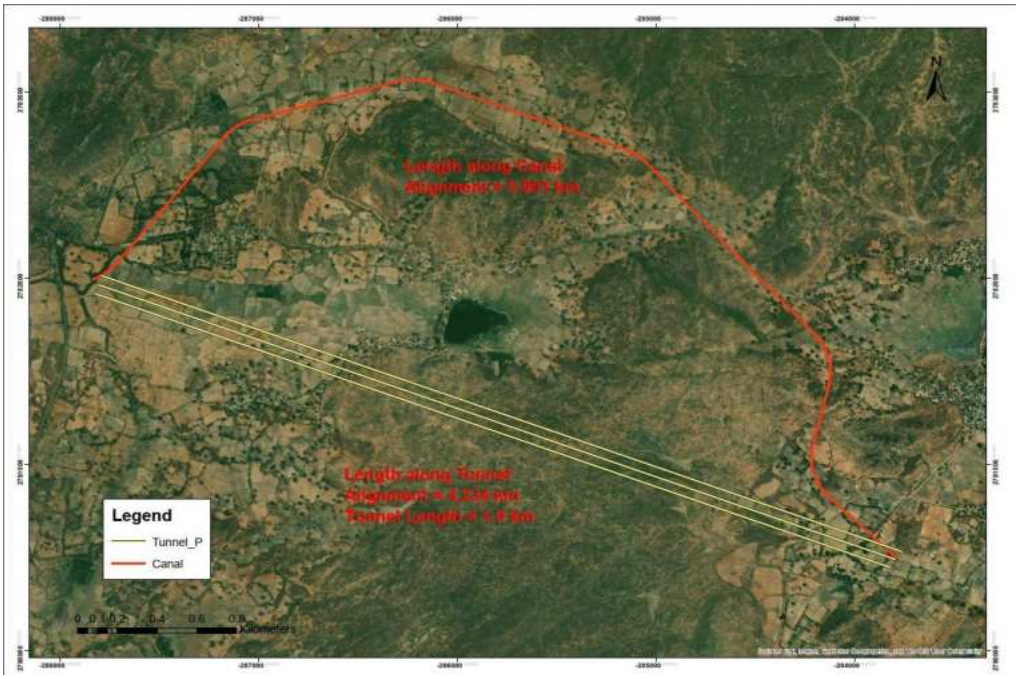
iii. The Chairman clarified that while the TAG had suggested exploring the straight route option with tunnel consideration during the eleventh meeting, no definitive recommendation had been formalized. Consequently, the TAG agreed that KBLPA should conduct desktop studies using available data for cost comparison purposes at the earliest opportunity.

iv. Additionally, the TAG advised planning a joint site visit during the TAG meeting to conduct preliminary site feasibility assessments. This visit would be strategically coordinated with the next TAG meeting, with site inspections scheduled prior to formal proceedings.

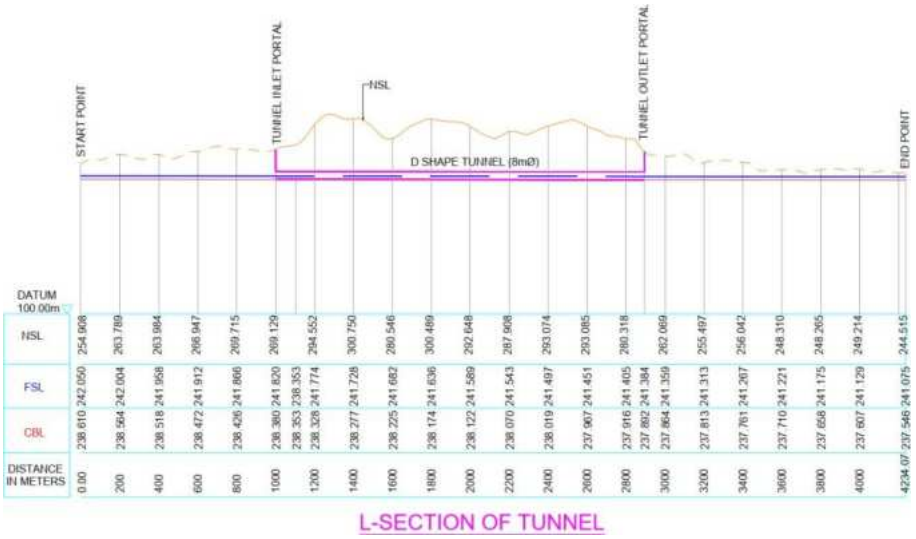
## 4. Technical Specifications and Desktop Study Results

i. The canal reach under consideration has following hydraulic design parameters:

| | Proposal 1 – Tunnel + Canal | | Proposal 2 – Fully Open Canal |
|---|---|---|---|
| | Canal | Tunnel | |
| RD (Start Point) | 116.1 Km + 4.1 Km | 116.1 Km + 5.1 Km | 116.1 Km + 4.1 Km |
| Length | 2.334 Km | 1.9 Km | 5.901 Km |
| Discharge (m3/s) | 76.23 | 76.23 | 76.23 |
| FSD (m) | 3.44 | 3.44 | 3.44 |
| Bed Slope | 1:10548 | 1:5507 | 1:10548 |
| Canal Bed Level (m) at start | 238.216 | 238.121 | 238.216 |
| Canal Bed Level (m) at end | 237.650 | 237.776 | 237.650 |
| FSL (m) at start | 241.656 | 241.561 | 241.656 |
| FSL (m) at end | 241.090 | 241.216 | 241.090 |
| Bottom Width (m) | 13.2 | 15.50 | 13.2 |




**Map showing original and revised alignment with the tunnel**




L-SECTION OF TUNNEL


L-SECTION OF CANAL

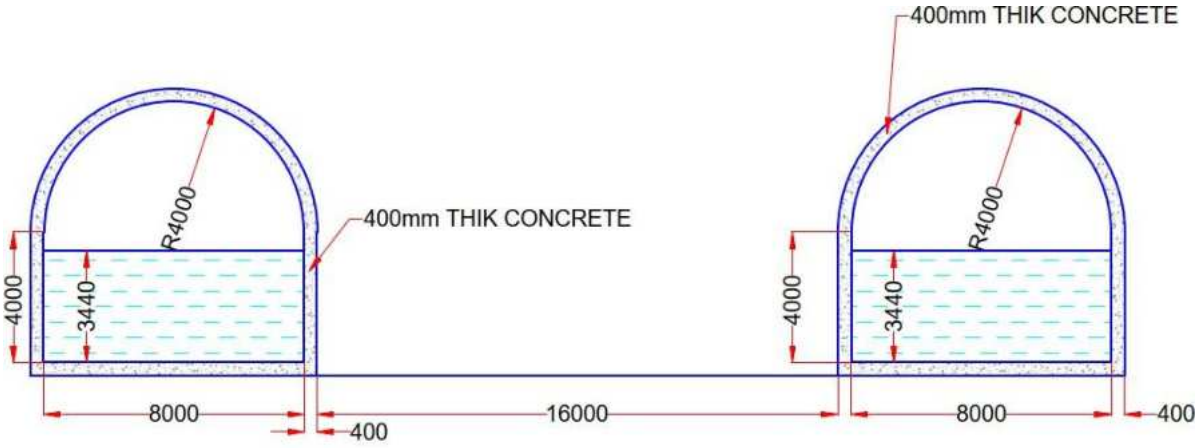
ii. The original canal alignment measures 5.901 km, while the alignment with tunnel & canal combination incorporation would span to 4.234 km, resulting in reduction of 1.667 km in total alignment length. Longitudinal section analysis indicates the technical feasibility of constructing approximately 1.900 km of tunnel within the 4.234 km revised alignment.

iii. However, the tunnel construction would require additional infrastructure specific to tunnel construction including transition structures at both inlet and outlet points, portal construction, systematic tunnel excavation, support system installation, and concrete lining throughout.

iv. The flow operation in tunnel requires a steeper gradient and significant hydraulic head compared to the canal. However, since the inlet and outlet levels are fixed, the required hydraulic head is not available. Therefore, construction of the tunnel in this reach may not be feasible.

v. To prevent silt deposition issues, the tunnel flow depth has been considered limited to 3.44 meters, matching the canal's design depth. This constraint necessitates a tunnel bed width of 15.50 meters. However, constructing a single tunnel of 15.50 meters diameter presents significant technical challenges and may not be practically feasible.

vi. Consequently, the study evaluated twin tunnel configuration with 8-meter diameter specifications may be considered as an alternative. This approach would provide equivalent hydraulic capacity while utilizing more conventional tunneling methodologies and equipment.




SECTION OF TWIN TUNNEL

## 5. Geological Regional Overview

i. The Bundelkhand region displays a geological succession spanning from Archaean to recent periods, representing approximately 2.5 billion years of Earth's history. The area is dominated by the Bundelkhand Granite Complex, radiometrically dated to over 2,500 million years, comprising coarse to medium-grained biotite and hornblende granites, banded gneisses, and migmatites with partial melting features indicating high-temperature metamorphic conditions.

ii. The granite complex contains several significant features including massive quartz reefs that form prominent ridges and affect drainage patterns, dolerite dyke swarms creating structural weakness zones, and pegmatite veins enriched in feldspar and quartz. Sedimentary formations overlie the granite basement in places, including the Paleoproterozoic Bijawar Group with quartzites, phyllites, and carbonates, and the younger Vindhyan Supergroup containing sandstones, shales, and limestones. The southwestern region features the Bakswaho Formation with diverse lithologies and Quaternary alluvial deposits in stream channels and valleys.

## 6. Local Geology of Tikamgarh District

i. Tikamgarh district forms part of the tectonically stable Bundelkhand Massif within the Indian Shield, where the Bundelkhand Granite Complex constitutes over 90% of bedrock beneath a thin soil cover. The region's structural stability with minimal tectonic activity since the Proterozoic indicates moderate seismic risk (Zone III) and limited recent deformation. Weathering profiles vary with topography and drainage, producing fresh granite at shallow depths in well-drained elevated areas and deeper weathered zones in low-lying areas.

ii. While the massive granite is generally suitable for tunneling, local discontinuities including joints, fractures, weathered zones, and intrusions may influence tunnelling project feasibility. The groundwater exhibits seasonal fluctuation with potential for joint and fracture-controlled flow patterns.

## 7. Hydrogeological Characteristics

i. Central Ground Water Board investigations reveal that the Palera area when the tunnel is considered as alternative features dual-porosity systems with water stored in weathered regolith and transmitted through fractured bedrock, while Jatara area aquifers are controlled entirely by fracture networks.

ii. These systems exhibit secondary porosity from weathering and fracturing, with permeability controlled by fracture density, aperture, and interconnectivity. Storage capacity is limited, depending on fracture volume and weathered zone thickness. The hydrogeological behavior is complex and heterogeneous, with significant variations in yield and water quality over short distances, making understanding of this variability crucial for engineering projects that may

encounter groundwater during excavation.

iii. Geological assessment based on available data and regional understanding indicates that the study area is predominantly underlain by fragmented Bundelkhand Granite complex that generally present challenging conditions for tunneling operations due to characteristic heavy jointing, advanced weathering, and fault systems.

iv. Field reconnaissance conducted during the preliminary site visit revealed substantial rock stability concerns, primarily associated with extensive rock disintegration and weathering processes that have compromised the integrity of the bedrock.

## 8. Engineering Challenges for Tunneling

i. Fractured granite in Tikamgarh district presents significant tunneling challenges due to its complex geotechnical behavior controlled by fracture network characteristics rather than intact rock properties. Key concerns include rock mass strength deterioration from fracture-induced weakness planes and potential progressive failure under sustained stress conditions.

ii. Hydrological complications arise from fracture networks creating preferential groundwater flow paths, leading to enhanced permeability, significant water ingress during excavation, and elevated pore water pressures that reduce effective stress and contribute to face instability.

iii. Excavation complexities include alternating zones of hard and fractured material requiring adaptive techniques, potential uncontrolled overbreak, increased tool wear, and reduced excavation rates with higher costs.

iv. Ground support requirements are extensive, typically involving systematic rock bolting for mass cohesion, steel ribs in heavily fractured zones, immediate shotcrete application for face stabilization, concrete lining for final support and waterproofing, comprehensive drainage systems, and continuous monitoring instrumentation.

v. Successful tunneling requires comprehensive site investigation including fracture mapping and hydrogeological assessment, adaptive excavation methods, robust support systems designed for worst-case conditions, effective water management through drainage and grouting, and continuous ground behavior monitoring throughout construction.

## 9. Financial Analysis and Cost Implications

i. For a quick and approximate cost comparison, reference data from an upper-level tunnel project with 8.5 m diameter was utilized as a benchmark. The reference project had an estimated cost of ₹89.42 crore for a single 8.5 m diameter tunnel spanning 1.871 km length. Additionally, cost data from a main canal project covering 218.695 km was available, with an estimated cost of ₹2145.85 crore excluding Cross Drainage structures and land acquisition cost.

ii. Based on these reference costs, the unit cost for tunnel construction works out to approximately ₹47.79 crore per kilometer, while the canal construction cost is approximately ₹9.81 crore per kilometer. Applying these unit rates to the proposed project, the estimated cost for Proposal 1 would be around ₹204.90 crore (twin tunnels of 1.90 km - ₹182 crore and Canal of 2.334 km - ₹22.9 crore) and for Proposal 2 would be around ₹57.89 crores (Canal of 5.901 km).

iii. The analysis reveals that although the Proposal 2 option being 1.667 km longer than the tunnel route, it would result in significant cost savings of approximately ₹147 crore, making it about 72% less expensive than the Proposal 1. This substantial cost differential highlights the economic advantage of the canal option over the tunnel solution for this particular project alignment. Further, it was the preferred alternative by GoMP also.

iv. Additionally, Proposal 1 requires the construction of an access road to the tunnel inlet, further increasing the overall project cost.

v. The financial analysis demonstrates that the tunnel proposal is costlier. The primary cost savings from reduced canal length are negated by the additional expenses associated with tunnel construction, resulting in a financially in favored proposition.

vi. Further, the tunnel construction approach would necessitate engaging specialized Road and Pipeline Construction (RPC) contractors and deploying high-cost tunneling equipment. For such a relatively short tunnel section, the mobilization and deployment costs of specialized equipment and expertise may increase the project cost.

## 10. Technical Challenges and Risk Assessment

i. Preliminary geological observations suggest significant concerns regarding rock stability throughout the proposed tunnel alignment. The presence of weathered and fractured granite suggests challenging excavation conditions and potential stability issues during construction. These geological conditions require extensive support systems and potentially more complex excavation methodologies, further increasing project costs and timeline requirements.

ii. The comprehensive geological investigations essential for accurate tunnel feasibility assessment are inherently time-intensive, requiring approximately more than six months. This timeline constraint conflicts with the project's urgent implementation requirements and could significantly impact the overall Ken-Betwa Link Canal project schedule.

iii. From an operational perspective, tunnel systems offer limited flexibility for future modifications, expansions, or the incorporation of additional distribution infrastructure such as tapping points or intermediate structures. Open canal systems, conversely, provide superior accessibility for inspection, maintenance, and future upgrades, ensuring long-term operational efficiency and adaptability.

iv. Furthermore, open canals facilitate straightforward water distribution to adjacent wells, ponds, and other water bodies through simple regulator installations. Tunnel systems require more complex infrastructure arrangements for similar distribution capabilities, potentially limiting the project's broader water management objectives.

**11. Comparative Advantages of Open Canal Systems**

i. Open canal construction offers several operational advantages that merit consideration in the final decision-making process. The accessibility provided by open channels enables routine inspection and maintenance activities using conventional equipment and methodologies. This accessibility leads to lower long-term operational costs and more reliable system performance.

ii. The flexibility inherent in open canal design allows for future modifications, capacity expansion, and the integration of additional water management infrastructure as regional requirements evolve. This adaptability represents significant value from a long-term asset management perspective.

iii. Additionally, open canals support distributed water management through simple offtake structures, enabling local water supply to agricultural areas, groundwater recharge facilities, and community water systems along the alignment. This distributed benefit maximizes the project's socioeconomic impact and supports broader regional development objectives.

**12. Costing Conclusions:**

i. The comprehensive desktop studies conducted in response to TAG recommendations indicate a preference for maintaining the original open canal alignment over the proposed tunnel alternative. While the tunnel option offers reduced alignment length through bend elimination, the associated technical challenges, financial implications, and operational constraints present significant concerns.

The total estimated construction costs for the two proposals are as follows:

- Proposal-1 (Tunnel + Canal combination): ₹204.90 crore
- Proposal-2 (Fully Open Canal): ₹57.89 crores

ii. The geological uncertainties, requirement for specialized construction expertise, limited operational flexibility, and extended investigation timeline collectively suggest that the tunnel option may not align with the project's immediate implementation requirements and long-term operational objectives.

iii. However, the site visit of TAG members whoever feels to visit as recommended by the TAG Chairman is suggested.

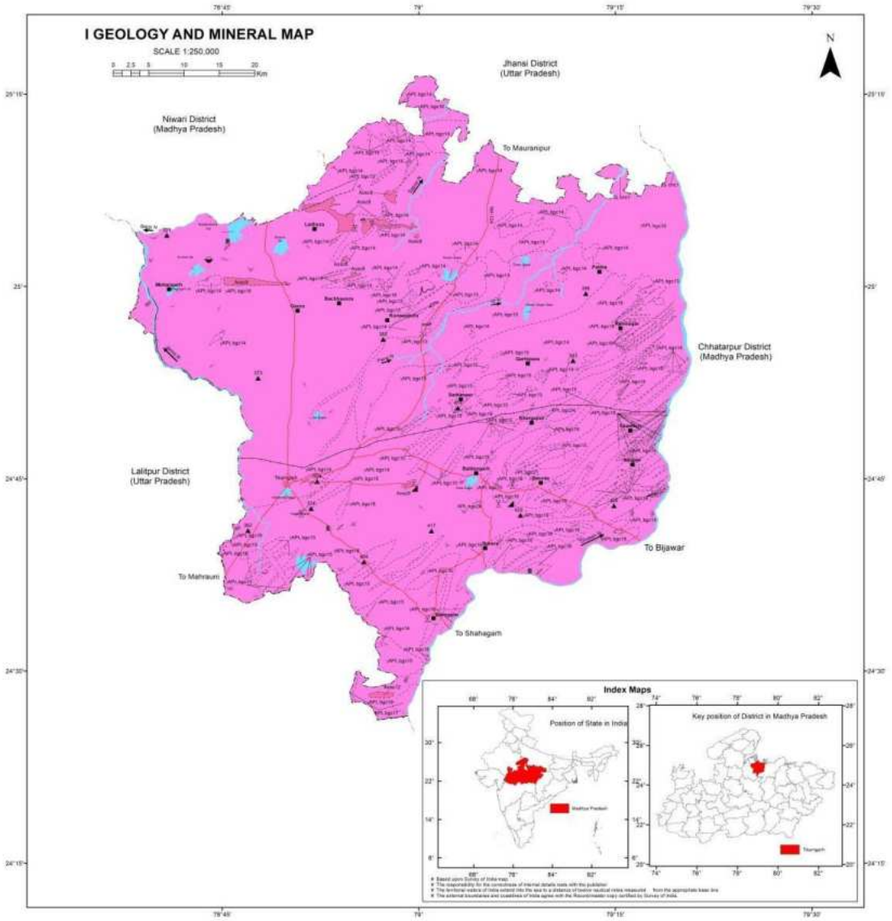
iv. The final proposal emphasizes proceeding with the original canal alignment to ensure preserving project timeline integrity and implementation readiness.

***

जिला संसाधन मानचित्र , टीकमगढ़ जिला,
मध्य प्रदेश , द्वितीय संस्करण 2024

# भारतीय भूवैज्ञानिक सर्वेक्षण
# GEOLOGICAL SURVEY OF INDIA

DISTRICT RESOURCE MAP,TIKAMGARH DISTRICT,
MADHYA PRADESH, SECOND EDITION 2024




LEGEND

| | LITHOLOGY | FORMATION | GROUP/SUPERGROUP | AGE | NATURE AND CHARACTERISTICS |
|---|---|---|---|---|---|
| Q, cnc1 | ALLUVIUM | CHAMBAL | CHAMBAL NEWER ALLUVIUM | HOLOCENE | Loose unconsolidated sediments |
| γAPt, bgc13 | FINE GRAINED GRANITE | | | | Occurs in the form of dykes cutting across granites and older metamorphics mostly alligned in NE-SW direction |
| γAPt, bgc14 | MEDIUM GRAINED GRANITE | | | | Grey to pink in color, exhibits intrusive relationship with coarse grained granite in |
| γAPt, bgc15 | PORPHYRITIC GRANITE | | | | Medium to coarse grained granite dominantly with phenocryst of feldspar |
| γAPt, bgc16 | COARSE GRAINED, PORPHYRITIC GRANITE | | BUNDELKHAND GRANITOID COMPLEX | ARCHAEAN- PALAEOPROTEROZOIC | Dominantly pink in color with phenocrysts of feldspar ranging in size from 6cm to 8 cm |
| APt, bgc17 | MIGMATITE | | | | Light grey to dark green fine grained banded and foliated rock |
| γAPt, bgc19 | GRANITE GNEISS | | | | It forms a gradational contact with metabasalts and chlorite schists and has variable composition |
| αPt, bgc21 | PYROXENITE | | | | It occurs as an enclave within porphyritic granites |
| APt, bgc24 | CHLORITE SCHIST | | | | It occurs as small lensoidal bodies within the granites |
| APt, bgc29 | MARBLE | | | | Crystalline marble trending NE-SW |
| Aoac8 | AMPHIBOLITE | | OLDER SUPRACRUSTAL | PALAEO-MESO ARCHAEAN | Medium to coarse grained, composed of hornblende, chloride,plagiocase feldspar,orthoclase and Biotite |
| Aosu12 | ENCLAVES OF METABASICS | | | | Dark greenish grey, fine to medium grained, foliated amphibolite rich |

**General Index**
- Locality
- District Headquarter
- Triangulation station(m)
- Roads
- Railway
- River flow direction
- District boundary
- State boundary
- Waterbody/River

**Structural Index**
- Inclined Joint
- vertical joint
- Inferred lithocontact
- Observed lithocontact

**Mineral Index**
- Baryte
- Diaspore
- Gypsum
- Lead ore
- Pyrite
- Pyrophyllite

## GEOLOGY NOTE

टीकमगढ़ जिला मध्य प्रदेश के उत्तरी भाग में स्थित है और इसका क्षेत्रफल 3878वर्ग किमी है। यह जिला उत्तर-पूर्व में झाँसी, उत्तर पश्चिम में निवाड़ी, दक्षिण-पूर्व में छतरपुर और दक्षिण-पश्चिम में ललितपुर जिलों से घिरा है। टीकमगढ़ जिला मुख्यालय है। जिले में 1 नगर पालिका परिषद, 7 नगर पंचायतें और 682 गांव हैं। टीकमगढ़ जिला सड़कों और रेलवे द्वारा अच्छी तरह से जुड़ा हुआ है। उत्तर मध्य रेलवे द्वारा संचालित ललितपुर-खजुराहो रेलवे लाइन जिले से होकर जाती है।NH-12A टीकमगढ़ जिले से होकर गुजरता है।

भू-आकृति विज्ञान की दृष्टि से , टीकमगढ़ जिला बुन्देलखण्ड उच्चभूमि के दक्षिण-पूर्वीभाग का हिस्सा है। भूमि का सामान्य ढलान उत्तर की ओर है। जिले में ग्रेनाइट के कटाव से बने पेडिप्लेन की प्रधानता है। कटाव-प्रतिरोधी कठोर चट्टान सामग्री ने इनसेलबर्ग का रूप ले लिया है। शंकाकार रूप में सतह से तेजी से उभरे हुए ऐसे इंसेलबर्ग टीकमगढ़ की एक विशिष्टलक्षण हैं। भूमि उपयोग के अनुसार, जिले का बड़ा हिस्सा कृषि भूमिएवं उसके बाद वन भूमि से आच्छादित है।

बुन्देलखण्ड ग्रेनिटॉइड कॉम्प्लेक्स से संबंधित ग्रेनाइट, मिग्मेटाइट और नाइस टीकमगढ़ जिले के लगभग पूरे क्षेत्र में व्याप्त है। बुन्देलखण्ड ग्रेनिटॉइड परिसर से संबंधित ग्रेनाइट, माइग्मेटाइट और नाइस टीकमगढ़ जिले के लगभग पूरे क्षेत्र में फैला हुआ है। बुन्देलखण्ड ग्रेनिटॉइड कॉम्प्लेक्स से संबंधित विभिन्न लिथोनाइट महीन से मध्यम दाने वाले गुलाबी ग्रेनाइट, पॉर्फिराइटिक ग्रेनाइट, पॉर्फिराइटिक ग्रेनाइट गनीस, पाइरोक्सेनाइट, एम्फिबोलाइट, क्लोराइट शिस्ट और संगमरमर के रूप में पाए जाते हैं। महीन दाने वाला ग्रेनाइट ग्रेनाइटों को काटने वाले बांधों के रूप में होता है और पुराने मेटामॉर्फिक्स ज्यादातर ENE-WSW और NE-SW दिशा में संरेखित होते हैं। मध्यम दाने वाला गुलाबी ग्रेनाइट मुख्य रूप से गुलाबी रंग का होता है , जो मोटे दाने वाले ग्रेनाइट के साथ मोटे तौर पर ई-डब्ल्यू प्रवृत्ति में दखल देने वाला संबंध प्रदर्शित करता है। मध्यम दाने वाला ग्रेनाइट भूरे से गुलाबी रंग का होता है , मोटे दाने वाले ग्रेनाइट के साथ मोटे तौर पर ई-डब्ल्यू प्रवृत्ति में घुसपैठ संबंध प्रदर्शित करता है। पोरफाइरिटिक ग्रेनाइट मध्यम से मोटे दाने वाला ग्रेनाइट है जिसमें मुख्य रूप से फेल्डस्पार का फेनोक्रिस्ट होता है। मोटे दाने वाला पॉर्फिराइटिक ग्रेनाइट मुख्य रूप से गुलाबी रंग का होता है जिसमें फेल्डस्पार के फेनोक्रिस्ट्स का आकार 6 सेमी से 8 सेमी तक होता है। माइगमाटाइट्स हल्के भूरे से गहरे हरे रंग के महीन दाने वाली चारीदार और पतेदार चट्टान के रूप में पाए जाते हैं। ग्रेनाइट नाइसेस क्लोराइट शिस्ट के साथ एक क्रमिक संपर्क बनाता है और इसकी संरचना परिवर्तनशील होती है। पाइरोक्सेनाइट एन्क्लेव के रूप में होता है और क्लोराइट शिस्ट ग्रेनाइट के भीतर छोटे लेंसॉइड बॉडी के रूप में होता है। संगमरमर प्रकृति में क्रिस्टलीय है और उत्तर-पूर्व में प्रचलित है। एम्फिबोलाइट की कुछ अलग-अलग घटनाएं होती हैं जो मध्यम से मोटे दाने वाली होती हैं, जो हॉर्नब्लेंड, क्लोराइड, प्लाजियोक्लेस फेल्डस्पार, ऑर्थोक्लेज़, बायोटाइट और मेटाबेसिक्स से बनी होती हैं, जो गहरे हरे भूरे रंग की होती हैं , महीन से मध्यम दाने वाली , पतेदार एम्फिबोलाइट उत्तरी में पुराने सुप्राक्रस्टल से समृद्ध होती हैंनदी चैनलों के आसपास के क्षेत्र के एक बहुत छोटे हिस्से पर चंबल संरचना के जलोढ़क व्याप्त है।

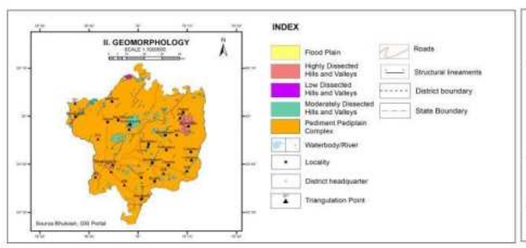
जिले से बैराइट, जिप्सम लेड अयस्क और पाइराइट की की उपस्थिति की सूचना मिली है। पाइरोफिलाइट और डायस्पोरा के कुछ भंडार सरकना, नंदवार, राजपुरा, धौरा और पूतना के पास पाए जाते हैं।

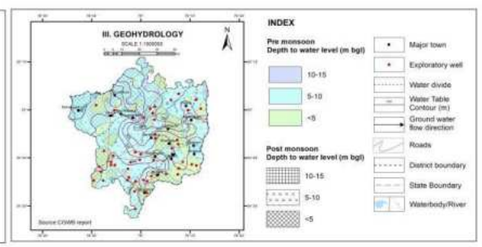
Tikamgarh district is situated in the northern part of Madhya Pradesh covers an area of 3878 $km^2$ The district is bounded by Jhansi district in the north east, Niwari district in the north west, chhatarpur district in south east and Lalitpur district in the south west. It spans from 24.43N to 25.27N and from 78.63E to 79.24E. Tikamgarh is the district headquarter. The district consists of 1 municipal council, 7 nagar panchayats and 682 villages. Tikamgarh district is well connected by roads and railways. Lalitpur- Khajuraho railway line, operated by North Central Railways transverses the district. NH-12A passes through the Tikamgarh district.

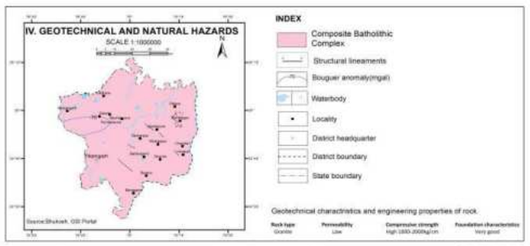
Geomorphologically, Tikamgarh district forms part of the southeastern portion of Bundelkhand upland. The general slope of the ground is towards north. The district is dominated by pediplains formed by the erosion of granites. Harder rock material resistant to erosion has taken the form of Inselbergs. Such Inselbergs, rising sharply from the surface in a conical form, are a distinctive feature of Tikamgarh. Granite, migmatite and gneiss belonging to Bundelkhand Granitoid Complex occupies almost the entire area of Tikamgarh district. The different lithounits belonging to Bundelkhand Granitoid complex occur in the form of fine to medium grained pink granite, porphyritic granite, porphyritic granite gneiss, pyroxenite, amphibolite, chlorite schist and marble. Fine grained granite occurs in the form of dykes cutting across granites and older metamorphics mostly aligned ENE-WSW and NE-SW direction. Medium grained pink granite is predominantly pink in color exhibiting intrusive relationship with coarse grained granite in roughly E-W trend. Medium grained granite is Grey to pink in color, exhibits intrusive relationship with coarse grained granite in roughly E-W trend. Porphyritic granite is medium to coarse grained granite dominantly with phenocryst of feldspar. Coarse grained porphyritic granite is dominantly pink in color with phenocrysts of feldspar ranging in size from 6cm to 8 cm. Migmatites occurs as light grey to dark green fine grained banded and foliated rock. Granite gneisses forms a gradational contact with chlorite schists and has variable composition. Pyroxenite occurs as enclave and chlorite schist occurs as small lensoid body within the granite. Marble is crystalline in nature trending NE-SW. There are a few isolated occurrences of amphibolite which are medium to coarse grained, composed of hornblende, chloride, plagiocase feldspar, orthoclase, biotite and metabasics which are dark greenish grey, fine to medium grained, foliated amphibolite rich belonging to older supracrustal in the northern and southern part of the district. A very small portion of the area around the river channels is occupies by alluvium of Chambal formation.

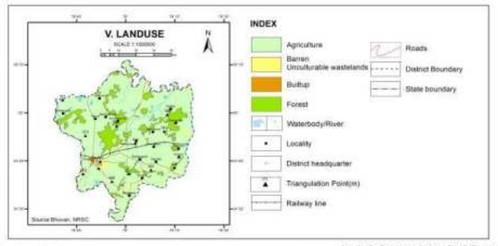
Techtonic framework of the district is composed of Composite Batholithic complex consisting of granite rocks characterized by low permeability and high compressive strength.

Baryte ,Gypsum Lead Ore and Pyrite have been reported from the district. Few deposits of Pyrophyllite and Diaspora occur near Sarkana, Nandwar, Rajpura, Dhaura and Putna.



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# Shri Sarbjit Singh Bakhshi,
# Chief Engineer,
# Designs (NW&S), CWC
# &
# Member-TAG

**Examination of note on techno-economic comparison of constructing a tunnel section for the Ken-Betwa Link Canal between RD 116.1 km and RD 125.7 km instead of proposed open channel submitted by KBLPA**

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This has reference to the MOM of the 11th TAG meeting held on 9&10 May 2025 wherein the technical review of the proposed modified alignment of KBLC was carried out by TAG of the KBLPA. The TAG agreed to the proposal of Govt of MP for all the reaches except for RD 116150m to 125622m (village Ramnagar). The two alternatives presented for this reach discussed in the TAG were (1) Canal: 5.89 km and (2) Tunnel: 1.5 km + Canal :2.75km.

After due deliberations the TAG gave the following recommendation:

"*The TAG noted that alignment proposed has multiple sharp bends and involves an additional length of 603 meters. The TAG also noted that there could be a straight route between coordinates E- 323029.938 N-2759607.085 and E- 319454.246 N-2760476.974, which would reduce the length of alternate alignment significantly. However, this route involves tunnel in around 1.5 km reach which may be feasible. In the light of this, the TAG suggested that the option of taking water through the tunnel/canal combination to the extent feasible may be explored between coordinates E-323029.938 N- 2759607.085 and E-319454.246 N- 2760476.974. This will reduce the length and minimize the bends in the water carrier, reduce the losses and thus will be more efficient*."

Subsequently, in the 12th TAG meeting, held on 28.7.2025, it was decided that for evaluating the proposal of Tunnel of length 1.5 km + Canal of length 2.75 km vis-à-vis Canal of length 5.89 km, KBPLA shall prepare a detailed note on techno-economic comparison of both the alternatives with respect to the cost & time of construction, cost of land acquisition, etc. alongwith the geological L-section and preliminary designs of the tunnel. These details shall be presented to TAG in its next meeting for deliberation and selecting the suitable alternative amongst the two.

Accordingly, Member Secretary TAG vide email dt 7th Aug 2025 shared the requisite details to all the Members for their consideration. The note annexed with agenda of 13$^{th}$ TAG meeting has been examined and the observations are as follows-

(i) With constraints of parameters such as fixed discharge (76.23 cumec), predetermined tunnel entry and exit points (slope of tunnel), the need to match the gradient of the tunnel with that of the canal, it is hydraulically feasible to convey the required discharge only either through a single large-sized tunnel or through twin smaller-sized tunnels. However, both these options shall be cost-intensive and time-consuming from a construction perspective.

(ii) It is also mentioned in the note that the CEO (KBLPA), ACEO (Canal) and officers from the WRD, GoMP and KBLPA officials visited the site to evaluate the feasibility of construction of tunnel near Ramnagar/Charee village in Tikamgarh District. The team after inspection of the site observed and indicated potential technical and financial challenges associated with choosing tunnel construction in place of open canal.

(iii) Further, it has been mentioned in the note, that the geology of the strata through which the tunnel is proposed to traverse comprises of weathered and fractured granite and suggests challenging excavation conditions and potential stability issues during construction. To confirm the above, additionally geo-technical investigations would be required for the tunnel design, which would further add to the time requirement of the project.

(iv) The cost comparison submitted by KBLPA - for Proposal 1 is about **₹57.89 crores** (Canal of 5.901 km) and for Proposal 2 is approx **₹204.90 crore** (twin tunnels of 1.90 km - ₹182 crore and Canal of 2.334 km - ₹22.9 crore). However, the cost of land acquisition in case of proposal 1 has not been considered.

(v) Furthermore, the proposal 1-open canal alignment has the operational advantages like easier maintenance, direct accessibility for inspections, greater flexibility for future upgrades, lower long-term maintenance costs and at the same time flexibility in allowing discharge adjustments as demand evolves in future, requires serious consideration.

From the above information/data submitted by KBLPA, it is inferred that the proposal -2 (tunnel + canal), though hydraulically feasible, is cost-intensive and time-consuming from the construction perspective. The difference in construction cost of the two proposals, as submitted by KBLPA, is appreciable though the land acquisition cost (not considered) may narrow down this difference in the total cost.

Therefore, in view of the above it is opined that the TAG may consider and opt for the open channel alternative-1 considering the advantages of open canal and constraints in hydraulic design of the tunnel in the instant case.

Sarbjit Singh Bakhshi
Chief Engineer, Designs (NW&S), CWC
Member TAG of the KBLPA.
11.08.2025

Shri Gyan Prakash Soni,

Former Chief Engineer,
WRD, MP

&

Member-TAG

**Re: Meeting Notice of 13th Meeting of Technical Advisory Group of Ken-Betwa Link Project Authority on 13.08.2025 & 14.08.2025 at Jhansi**

*31 emails*

**Gyan Prakash Soni** < gpsoni42@gmail.com >

Mon, 11 Aug 2025 12:49:29 PM +0530

The calculations for the approximate cost calculation of the tunnel has been made by me which is roughly 101 cr. The proposal incidentally avoids construction of two MDR Bridges and two culvers/syphons. My only suggestion is not to push through things but to have comprehensive technical review as well as economic criteria is also important to a fair degree. We have examples here that the tunnels constructed cor canal have been running successfully for past 25 to 40 years with zero maintenance whereas at atleast one lining replacement in canal occurs in 15 to 25 years. This canal is aligned along the foothill in parts which is going to face huge problems unless permanent drainage on the adjoining banks are not made, which i an sure wouldn't be the part of directives in the tender, if costs are to be compared both the proposals should be brought to same level of competency.

Regards
G.P.Soni
.

On Mon, Aug 11, 2025 at 12:00 PM Pradeep Saxena <saxena.pk@gmail.com> wrote:

--
Regards,

G. P. Soni
Sir

Shri Pradeep Kumar Saxena,
Former Commissioner(Indus),
DoWR, RD&GR
&
Member-TAG

**Re: Meeting Notice of 13th Meeting of Technical Advisory Group of Ken-Betwa Link Project Authority on 13.08.2025 & 14.08.2025 at Jhansi**

*29 emails*

**Pradeep Saxena** < saxena.pk@gmail.com >

Mon, 11 Aug 2025 12:00:46 PM +0530

Sir

The tunnel option may not save as much money on land acquisition as initially expected. Even with twin tunnels, we would still need to acquire about 35 meters of land width, so the cost difference won't be that significant. Any small savings we might get from reduced land acquisition will likely be cancelled out by the much higher costs of building the tunnel itself.

If we decide to go with the tunnel option, we will need at least six more months for detailed investigation before we can even start the tender process. This delay might also require us to get a fresh technical approval, which adds more uncertainty to the project timeline. The tunnel construction will require specialized experts for the 1.5-kilometer section, which will make the project much more expensive and complicated.

Looking at all these factors, the tunnel option doesn't offer enough benefits to justify changing our current plans. The small potential savings in land costs are outweighed by higher construction costs, longer project delays, the need for specialized contractors, and possible approval delays.

For the final technical decision, we should rely on the Central Water Commission's expert recommendations on this matter.

Sent from my iPhone

On 11 Aug 2025, at 11:57 AM, Vijai Saran <vijaisaran42@gmail.com> wrote:

Shri Vijai Saran,

Former Chief Engineer,

CWC

&

Member-TAG

Sir,

As per the Desk Study submitted by KBLPA, the cost of construction of proposal-1( canal+tunnel) is about Rs 204 Cr while that of proposal-2( only canal) is Rs 57 Crores. Further, ACEO, Canal has informed that cost of Land Acquisition is roughly Rs 10 crores and hence will not affect cost comparison between the two alternatives.

However, KBLPA may ensure that cost estimate includes all components and if any CD works are avoided in the tunnel option, the same should be duly accounted for.

As per the Desk Study submitted presently, the proposal -2 is quite economical and hence may be considered.

Regards

Vijai Saran,
Member, TAG

On Fri, Aug 8, 2025 at 3:06 PM Vijai Saran <vijaisaran42@gmail.com> wrote:

Sir,
I have gone through the desk study submitted by KBLPA.

Comments on the Desk study is given below:
1) The cost comparison shows only the cost of construction. In order to choose between the two alternatives the total cost of both alternatives must be furnished. The cost of land acquisition for both proposals are not given in the desk study and same should be furnished.
2) The design calculations for arriving the size of the twin tunnel to carry a discharge of 76 cumecs may be shared for further examination.

After receipt of the above information, it would be possible to select the preferred option.

Regards
Vijai Saran

On Thu, Aug 7, 2025 at 4:48 PM Trinetra Mani Tripathi <aceocanal-kblpa@gov.in> wrote:

Sir/Madam,

Please find notice for 13th meeting of Technical Advisory Group of Ken Betwa Link Project Authority (TAG-KBLPA) under the Chairmanship of Shri D. P. Bhargava, Former Director, (Technical), NHPC, Faridabad which is proposed to held on 13.08.2025 & 14.08.2025 at 11:00 hrs at Jhansi.

ACEO(Canal)

Shri Raj Kumar Mishra,
ACEO(HW),
KBLPA
&
Member-TAG

**Fwd: Re: Meeting Notice of 13th Meeting of Technical Advisory Group of Ken-Betwa Link Project Authority on 13.08.2025 & 14.08.2025 at Jhansi**

*30 emails*

**Raj Kumar Mishra** < aceohwbpl-kblpa@gov.in >

Mon, 11 Aug 2025 12:44:56 PM +0530

Sir,

I have gone through the desk study done by Canal Unit of KBLPA. There is significant cost difference between the two options. Even if there had been less difference or no difference in cost, still open canal option would have been better. For tunnel excavation certain investigations are required for which 4-6 months will be required. Further, there are intangible benefits of the open canal eg improvement in ambience, ground water table improvement, availability of water for drinking to animals and fulfilment of aspirations of local people. Hence, I find open canal option better.

Shri Prabhat Kumar Dubey,
ACEO(DP),
KBLP, IWRD
&
Member-TAG

**Proposal for the technical advisory group for tunnel between RD 116.1 km and RD 125.7 km of Ken-Betwa link canal**

**PRABHAT KUMAR DUBEY** < aceo.dp.kblpup@gmail.com >

Sun, 10 Aug 2025 7:05:34 PM +0530

Dear Sir,

Some observations after the perusal of the Proposal for the technical advisory group for tunnel between RD 116.1 km and RD 125.7 km of Ken-Betwa link canal:

1) In the Technical Specifications and Desktop Study Results it is mentioned, "*The flow operation in the tunnel requires a steeper gradient and significant hydraulic head compared to the canal. However, since the inlet and outlet levels are fixed, the required hydraulic head is not available. Therefore, construction of the tunnel in this reach may not be feasible.*"

As per my understanding, by maintaining the slope envisaged in the original alignment for the open channel in the 1st alternative (open channel plus tunnel) which is 1,600 m shorter than the 2nd alternative (open channel only), the gradient saved in the shortened length can be transferred to the tunnel portion, allowing it to be made steeper. So, this point needs consideration.

2) In the cost analysis, the value of land saved due to the reduced length in the 1st alternative (open channel plus tunnel) and for the tunnel (in case land is not required to be acquired) has not been considered. The cost of the land is assumed to be within ₹10 crore.

In conclusion, the overall techno-economic feasibility report, based on the reconnaissance survey and primary investigation, is comprehensive and conclusive. As noted in the report, the original alignment offers several advantages in addition to adherence to the project schedule. **I find the report satisfactory and, on that basis, support the original alignment, i.e., the open canal.**

Thanks and regards.

Prabhat Kumar Dubey
ACEO, DP
KBLP, IWRD
Lucknow

Shri V.K. Niranjan,

Former HOD & E-in-C,

I&WRD, UP

&

Member-TAG

Based on the inputs provided, comments are as follows

By adopting Canal+ tunnel alignment, there is reduction of about 1.73 km in alignment length. The longitudinal slope of tunnel is 1:5507. However, Canal after the Chainage 4.237 km of Canal and tunnel alignment and 5.901 km of fully open Canal alignment (Though not provided in the inputs) assuming that remains the same, the advantage of increased slope in Canal and tunnel alignment does not carry much significance.

Given that tunnel will involve many other complications given fractured granite in Tikamgarh district rather than intact granite, Ingress of water during excavation and pore water pressure. This alignment will also involve construction and operational challenges. At the same time increased cost of about 204.90 cr makes the proposal much weaker for consideration.

Fully open Channel alignment will have increased length of about 1.73 km. However, this proposal involves many bends and increased length, resulting in some head losses. However, cost of fully open. Channel alignment is considerably less saving around 147 crore This factor is very significant in consideration of selection the Channel alignment. Fully open Canal alignment will also have comparable much simpler construction, and after construction, operation and maintenance will also be much easy and uncomplicated.

Therefore, in my view, fully open, channel alignment should be adopted instead of Canal and tunnel alignment.

Annexure-V

Irrigation and Water Resources Department, U.P.

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# Finalising Pond Level of Banda Barrage

Dated : 13.08.2025

## ACEO, Ken Betwa Link Canal (Construction),Jhansi

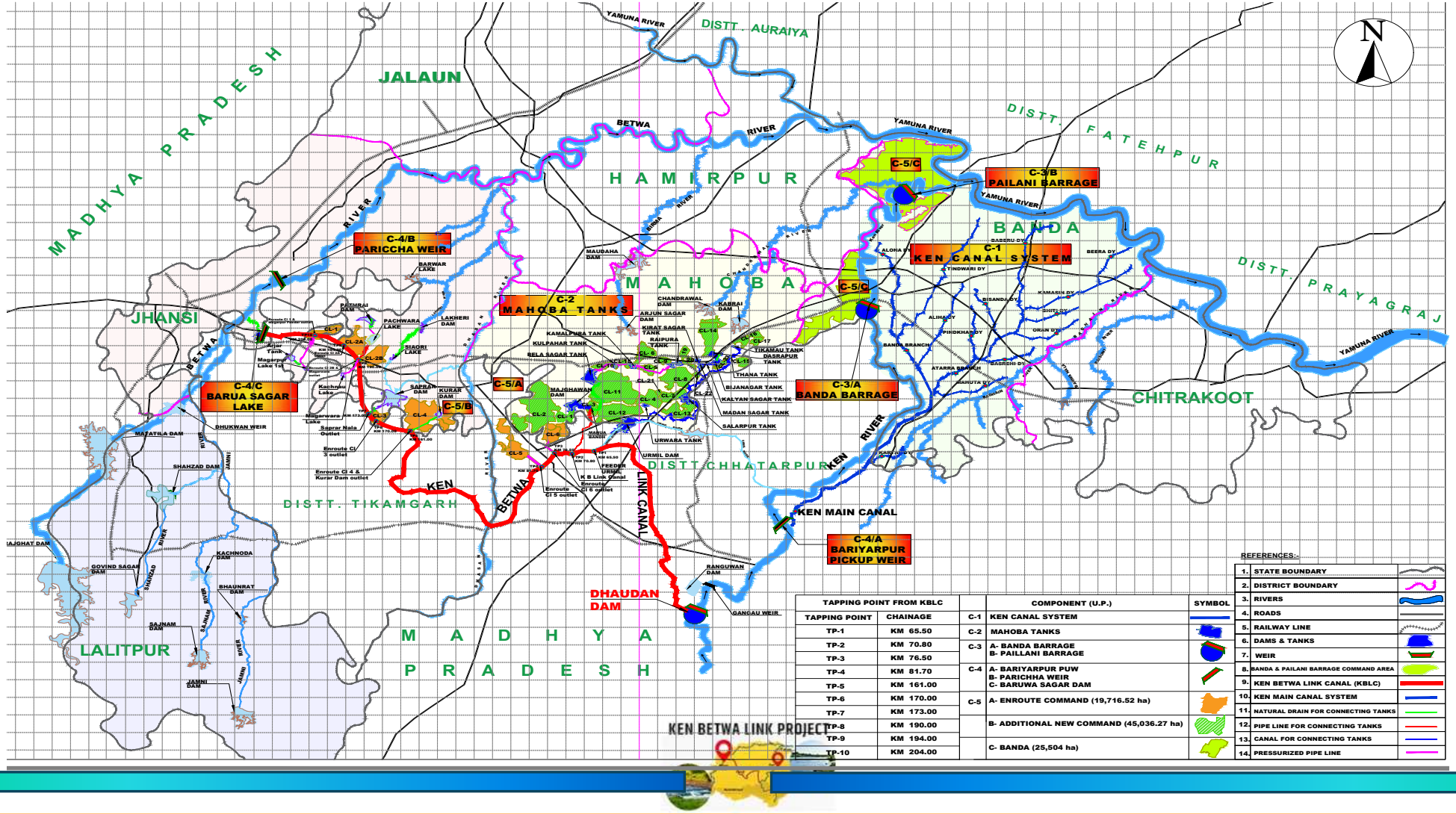
# Ken Betwa Link Project

- Ken-Betwa Link Project (KBLP) is India's first river interlinking project, designed to transfer surplus water from the Ken River to the water-deficient Betwa River basin.

## Aim of Project

The project aims to address water scarcity in the Bundelkhand region, which spans parts of Madhya Pradesh and Uttar Pradesh to provide water for drinking and irrigation

# Index Map of Ken-Betwa Link Project (UP Component)




| TAPPING POINT FROM KBLC | |
|---|---|
| TAPPING POINT | CHAINAGE |
| TP-1 | KM 65.50 |
| TP-2 | KM 70.80 |
| TP-3 | KM 76.50 |
| TP-4 | KM 81.70 |
| TP-5 | KM 161.00 |
| TP-6 | KM 170.00 |
| TP-7 | KM 173.00 |
| TP-8 | KM 190.00 |
| TP-9 | KM 194.00 |
| TP-10 | KM 204.00 |

| | COMPONENT (U.P.) | SYMBOL |
|---|---|---|
| C-1 | KEN CANAL SYSTEM | |
| C-2 | MAHOBA TANKS | |
| C-3 | A- BANDA BARRAGE<br>B- PAILLANI BARRAGE | |
| C-4 | A- BARIYARPUR PUW<br>B- PARICHHA WEIR<br>C- BARUWA SAGAR DAM | |
| C-5 | A- ENROUTE COMMAND (19,716.52 ha) | |
| | B- ADDITIONAL NEW COMMAND (45,036.27 ha) | |
| | C- BANDA (25,504 ha) | |

REFERENCES:-

| | |
|---|---|
| 1. | STATE BOUNDARY |
| 2. | DISTRICT BOUNDARY |
| 3. | RIVERS |
| 4. | ROADS |
| 5. | RAILWAY LINE |
| 6. | DAMS & TANKS |
| 7. | WEIR |
| 8. | BANDA & PAILANI BARRAGE COMMAND AREA |
| 9. | KEN BETWA LINK CANAL (KBLC) |
| 10. | KEN MAIN CANAL SYSTEM |
| 11. | NATURAL DRAIN FOR CONNECTING TANKS |
| 12. | PIPE LINE FOR CONNECTING TANKS |
| 13. | CANAL FOR CONNECTING TANKS |
| 14. | PRESSURIZED PIPE LINE |

# Banda Barrage

## Purpose

- To provide water for drinking purpose and facilitate 13000 hectares of irrigation in Banda district. For which a total of 100 MCM (Drinking water- 40 MCM, Irrigation- 60 MCM) water is required

# Location of Banda Barrage

- A joint visit of officers of CWC, IWRD, NWDA and KBLA was held on 20.05.2022 for finalising the location of Banda barrage
- In a meeting on 30.05.2022 at CWC New Delhi, location of Banda Barrage was finalised at RD 64.000 on Ken river.
- Lat/Long- 25°28'47.09" N and 80°18'48.48" E (between Bhuragarh Bridge and CWC Gauge site)

# New Location of Banda Barrage

## Reason

- Due to apprehension of interference of affluxed water level of Barrage with the sill level of upstream railway bridge deck.

## New Location

- A joint visit of officers of CWC, NWDA, CSMRS, GSI, IWRD UP, IWRD MP, and KBLA was held on 06.05.2024 for finalising the location of Banda barrage at RD 66.800 on Ken river (2.8 km u/s of old location)

# Of three alternatives, 5th CS was found most suitable


4TH

Banda Barrage Axis Selection


3RD

5TH


# Reasons for selecting 5th CS for Barrage construction

- No issue of interference of under construction bridge due to affluxed water level
- Stable and firm banks
- Nearly straight reach of the river
- Availability of sufficient waterway

KEN BETWA LINK PROJECT

# Point of Concern

- In detailed survey, the total storage capacity of Banda Barrage was found 55.214 MCM which is nearly half the previously envisaged storage capacity of 107 MCM
- The use of barrage will only be limited to the supply of drinking water.
- No irrigation facility would be available to the farmers.

***Thus the state of Uttar Pradesh will not be fully benefited by Ken-Betwa Link Project.***

# Barrage storage capacity at various Pond Level

| Pond Level (m) | Tentative Capacity (MCM) | Tentative Submergence (ha) | Tentative Fetch Length (km) | Average Bank Level (m) |
|---|---|---|---|---|
| 104.0 | 55.214 | 1209.04 | 21.70 | **L/B-** 110.00, **R/B-** 111.00 |
| 105.0 | 64.500 | 1270.29 | 21.95 | *Clearly water level of Ken river will remain within the banks (from pond level 104m to 109 m)* |
| 106.0 | 75.500 | 1397.43 | 22.20 | |
| 107.0 | 85.000 | 1494.47 | 22.86 | |

# Barrage storage capacity at various Pond Level

| Pond Level (m) | Tentative Capacity (MCM) | Tentative Submergence (ha) | Tentative Fetch Length (km) | Average Bank Level (m) |
|---|---|---|---|---|
| 108.0 | 90.500 | 1520 | 30 | **L/B-** 110.00, **R/B-** 111.00 |
| 109.0 | 98.500 | 1590 | 31.6 | *Clearly water level of Ken river will remain within the banks (from pond level 104m to 109 m)* |

# Submergence Area distribution

*(in ha)*

| Land Type | Submergence area at various Pond Level | | | |
|---|---|---|---|---|
| | 104.00 m | 105.00 m | 106.00 m | 107.00 m |
| **Total Submergence** | 1209.04 | 1270.29 | 1397.43 | 1494.47 |
| (-) Between banks | 1144.84 | 1175.21 | 1247 | 1324.13 |
| (-) Forest Area | 2.1 | 3.0 | 4.2 | 5.6 |
| **Balance Area** | **62.1** | **91.08** | **146.23** | **164.74** |
| • Residential Area (Building, Roads, Bridges) | 0.15 | 0.035 | 0.59 | 0.67 |
| • Barren/ Fallow Land | 9.633 | 13.28 | 22.99 | 32.65 |
| • Agricultural Land | 52.316 | 70 | 119 | 121.1 |
| • Nala | | 8.45 | 3.625 | 10.31 |

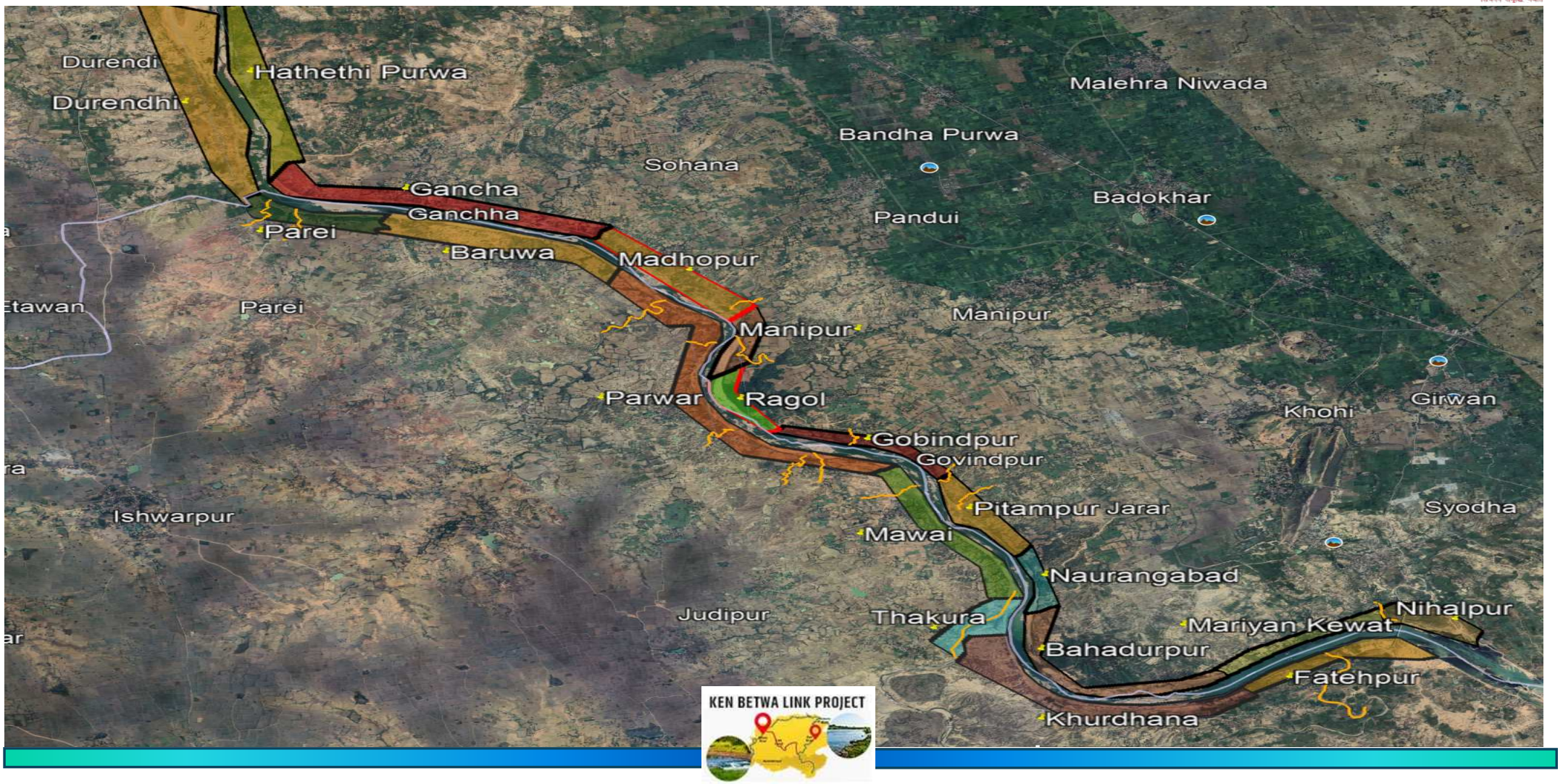
# Banda Barrage on Survey of India Toposheet

# How MP would be benefitted by raising Pond level

- Assured availability of water throughout the year
- Groundwater recharge
- Availability of drinking water via underground drinking water schemes
- Improvement in water quality
- Animal husbandry
- Tourism
- Economic Development

*As a result of strengthening the banks of Ken river, transport facilities will be developed for the regional people*

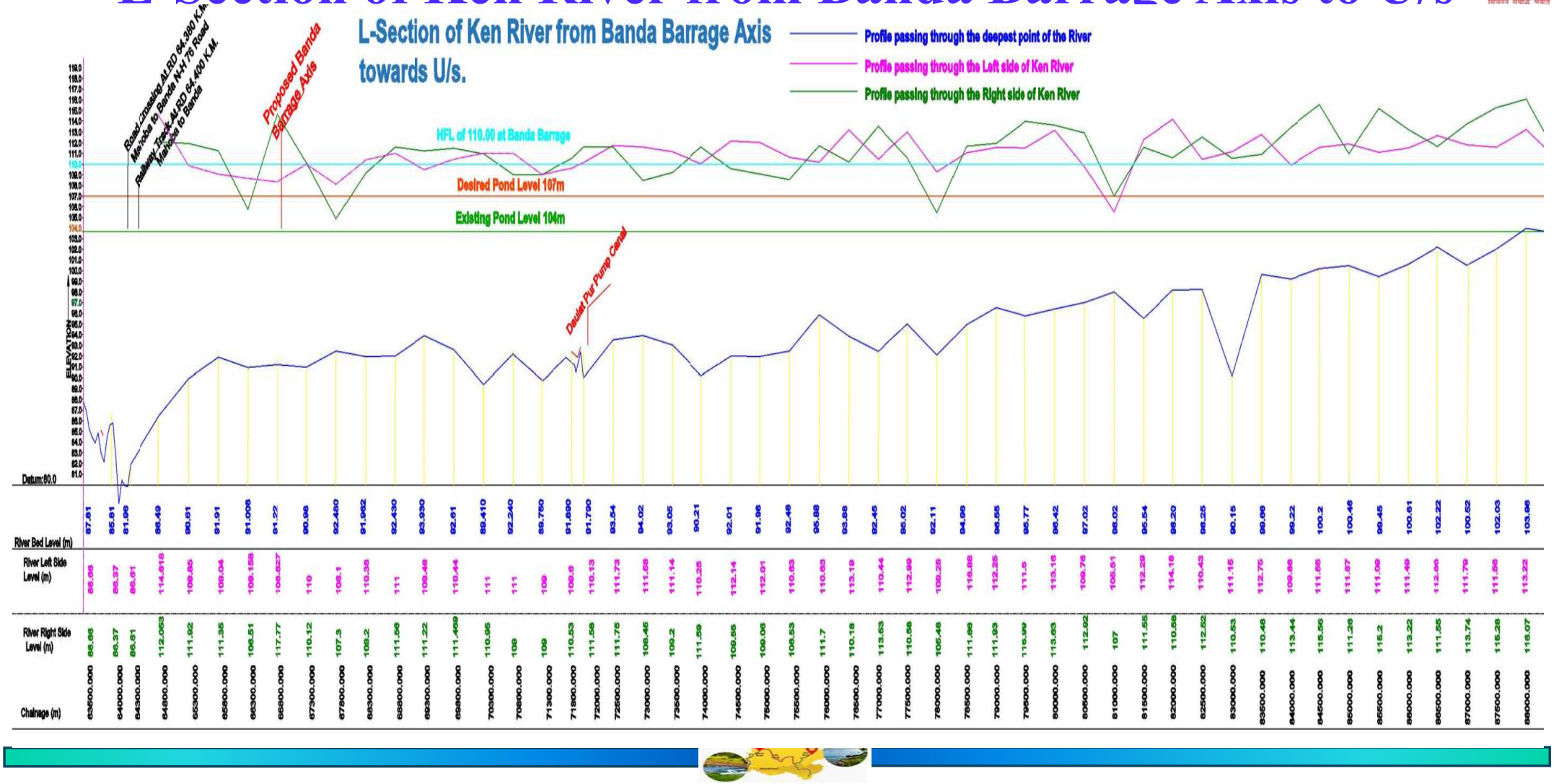
# Villages on the banks of River Ken



# Affected Villages

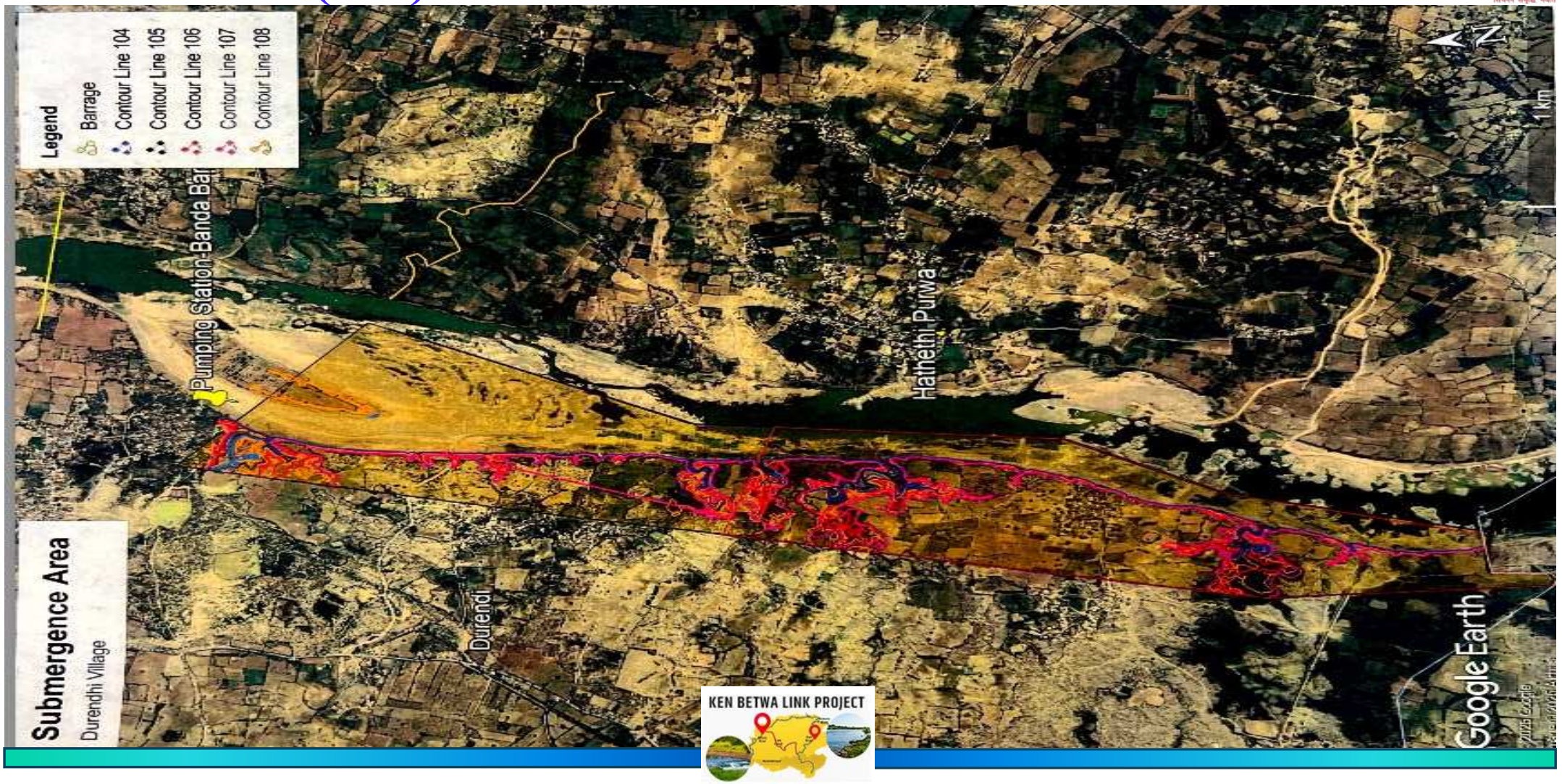
| Villages on Left Side | Villages on Right Side |
|---|---|
| Durendi (UP) | Hatheti Purwa (UP) |
| Daulatpur (UP) | Gancha (UP) |
| Parei (MP) | Madhopur (UP) |
| Barwa (MP) | Manipur (UP) |
| Parwar (MP) | Ragol (UP) |
| Mawai (MP) | Gobindpur (UP) |
| Thakura (MP) | Pitampur Jarar (UP) |
| Khurdhana (MP) | Naurangabad (UP) |
| Fatehpur (MP) | Bahadurpur (UP) |

# L-Section of Ken River from Banda Barrage Axis to U/s



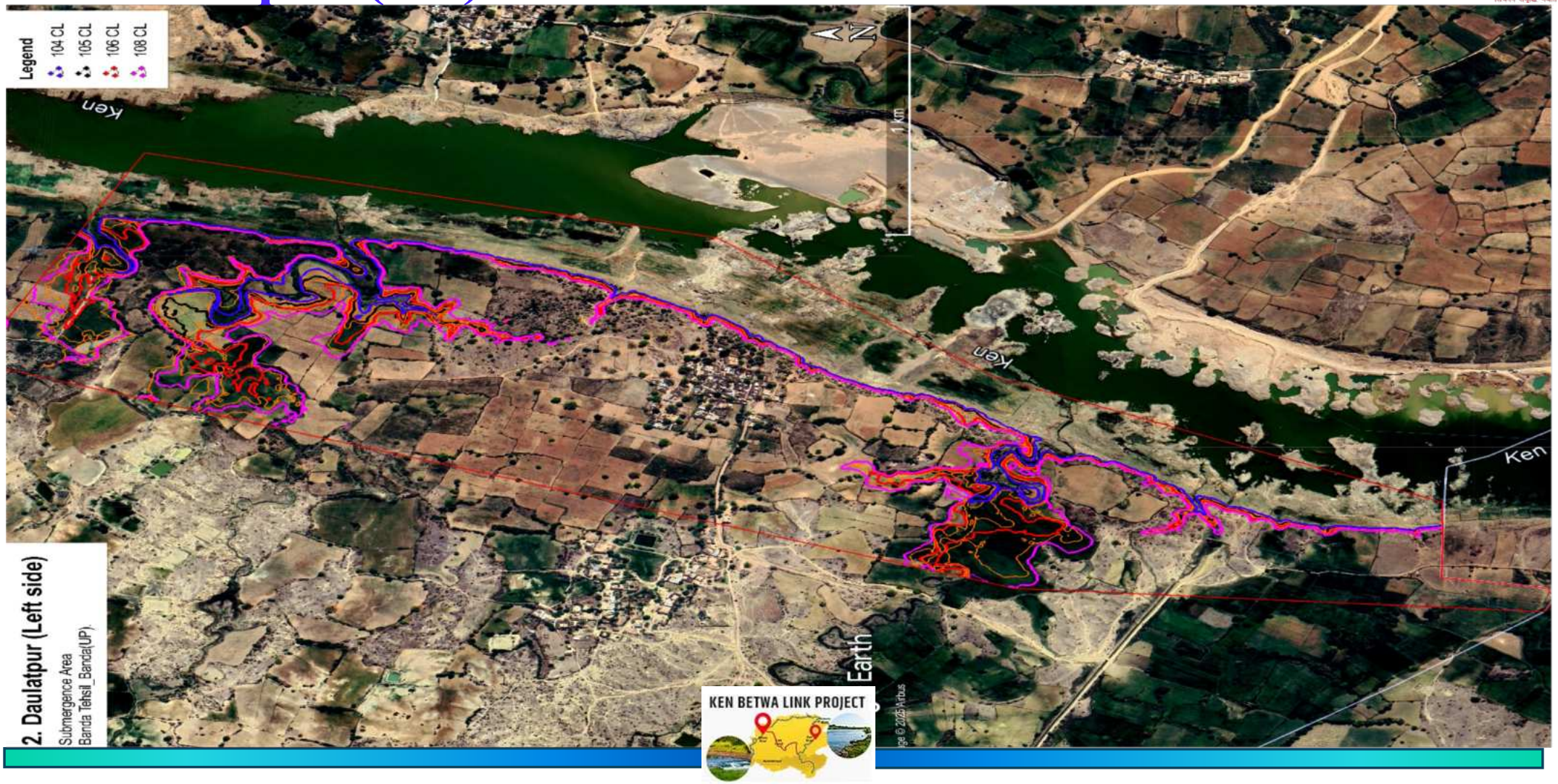
# 1. Durendi (UP)

## Left Side



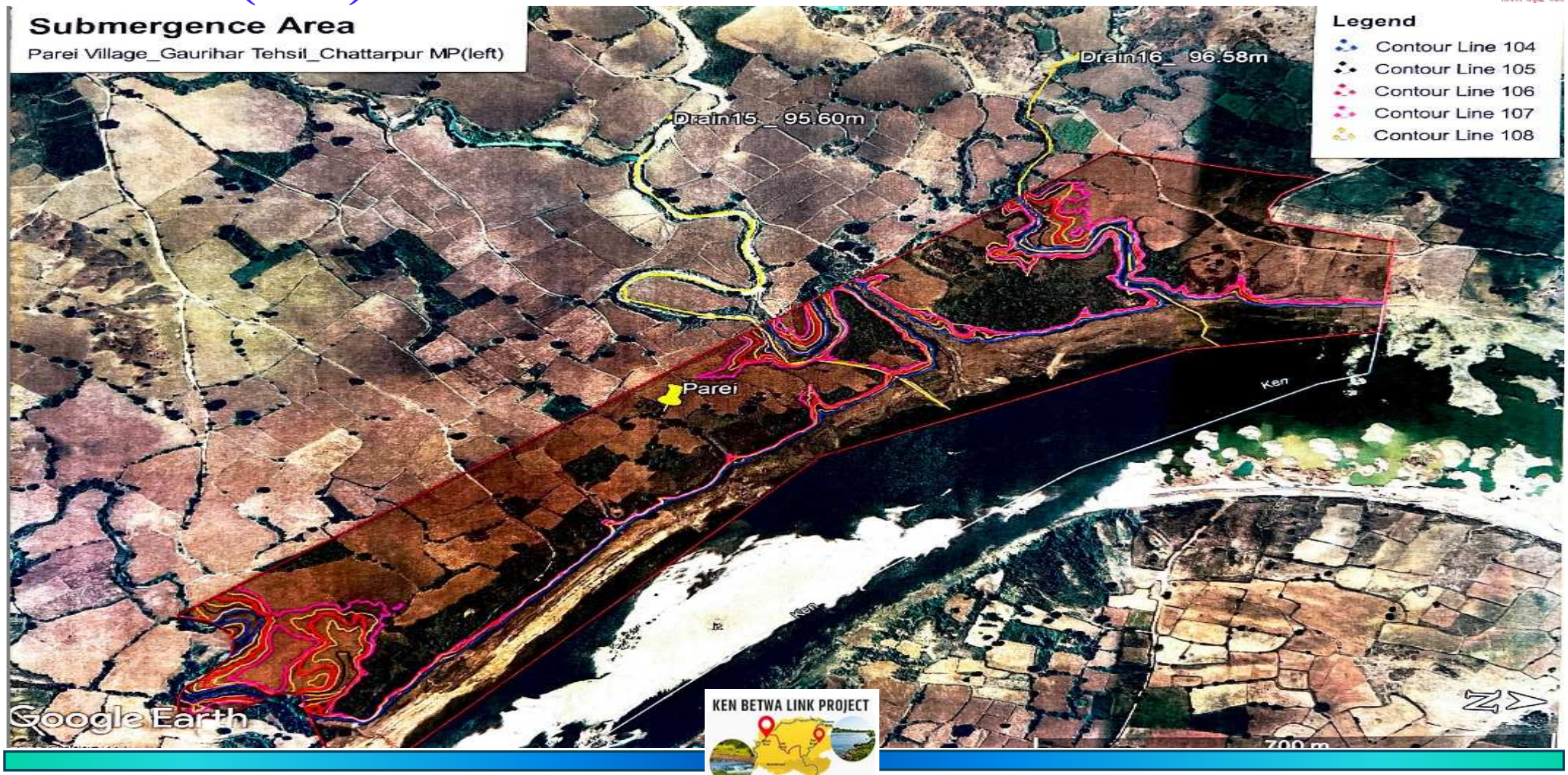
# 2. Daulatpur (UP)

# Left Side



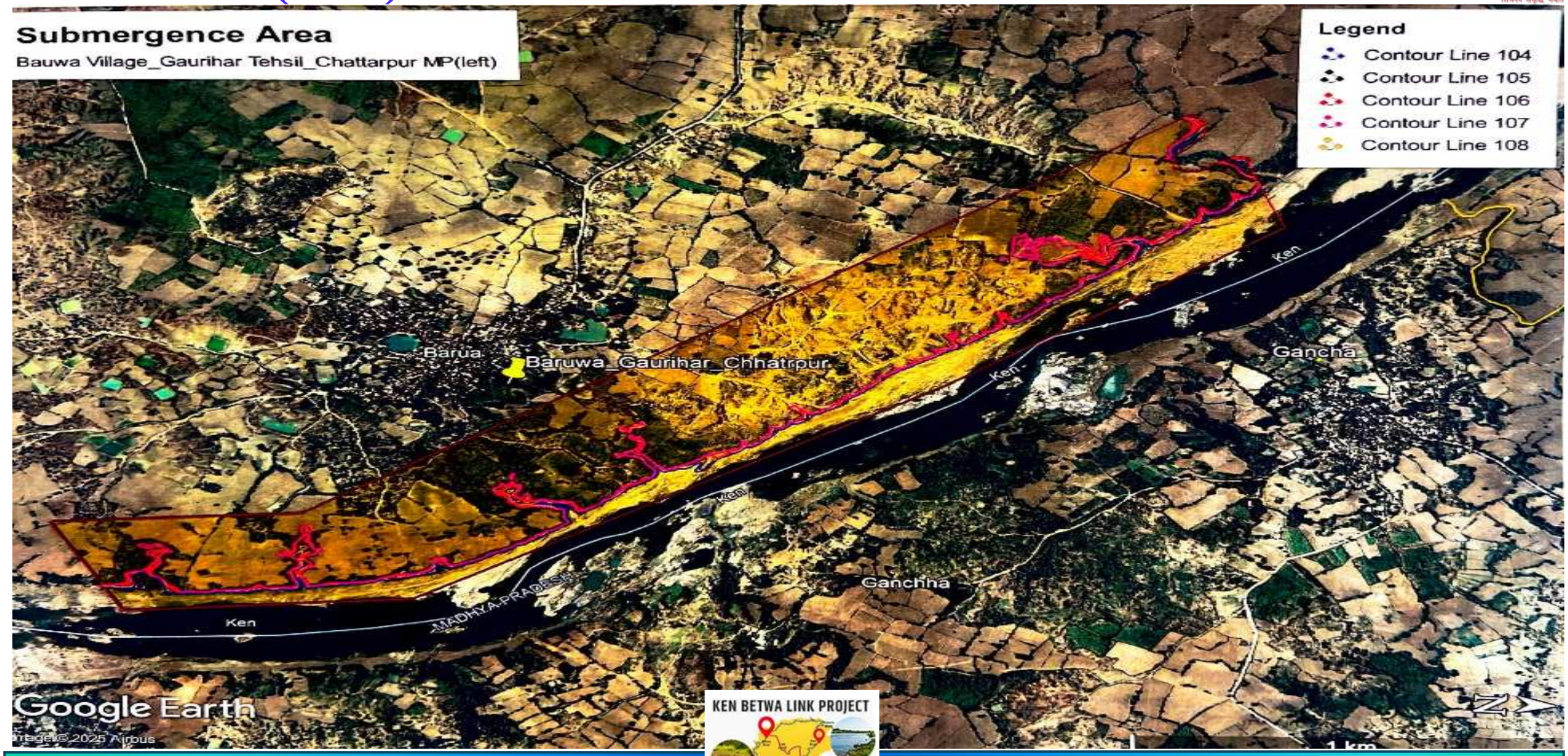
# 3. Parei (MP)

# Left Side



# 4. Barwa (MP)

## Left Side

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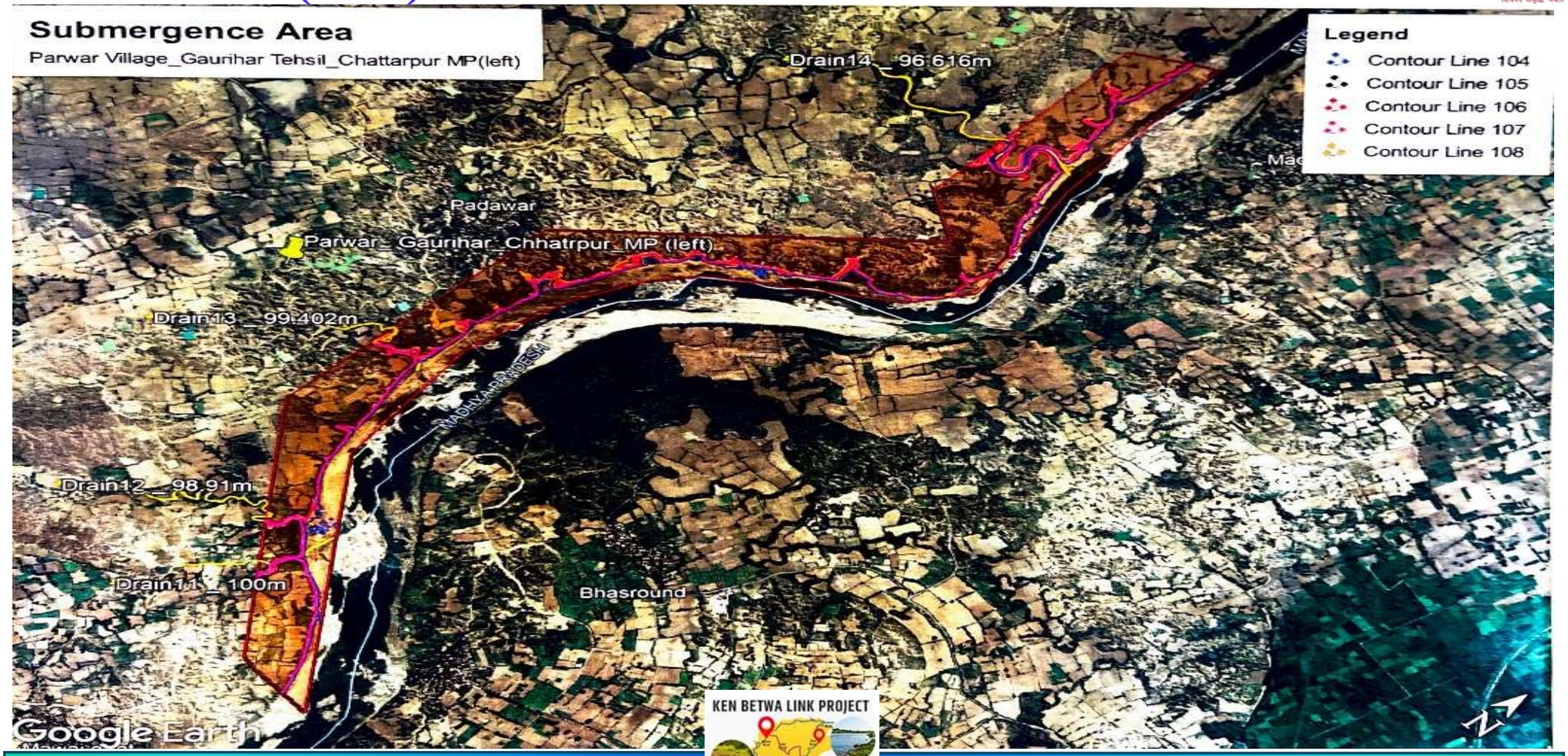
# 5. Parwar (MP)

## Left Side

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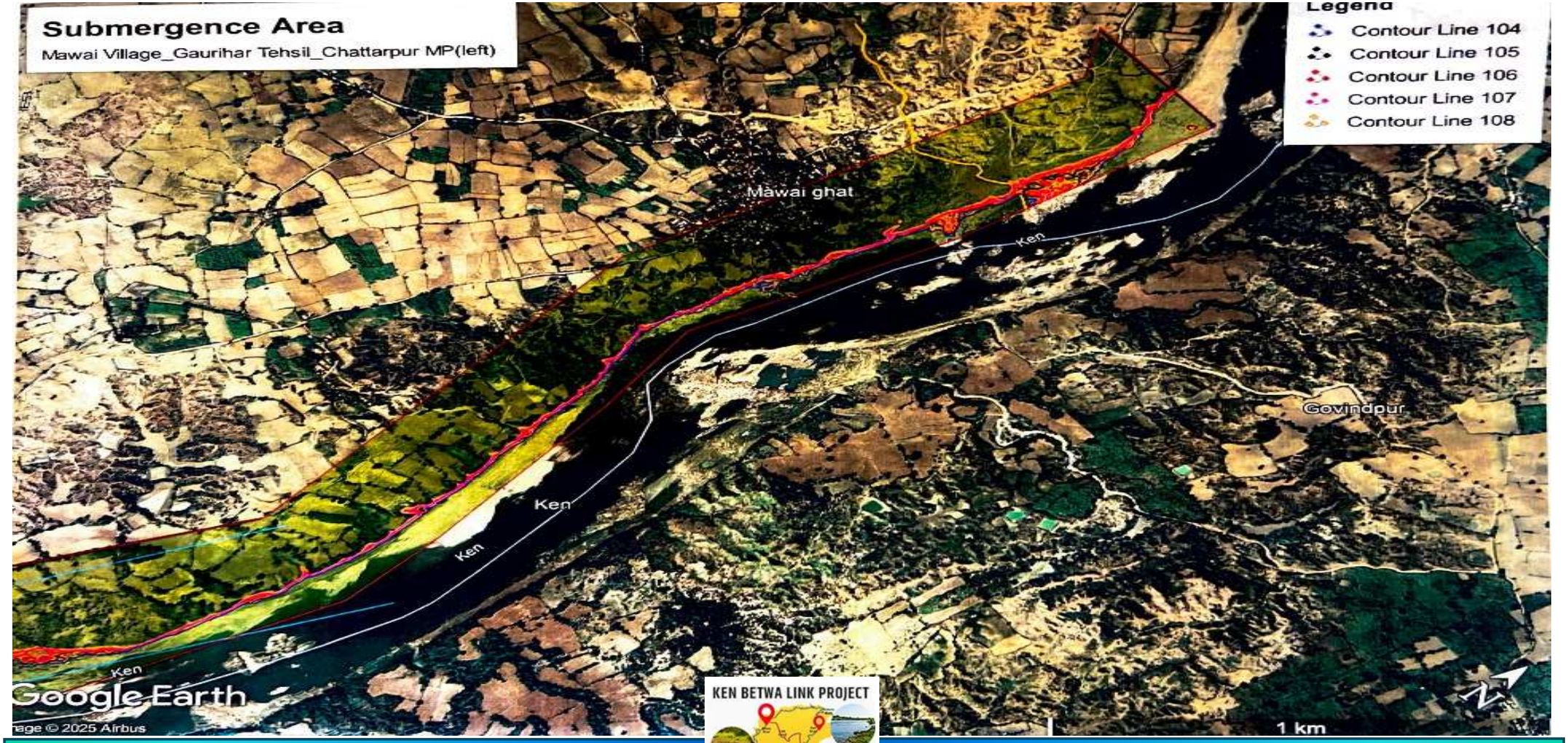
# 6. Mawai (MP)

# Left Side

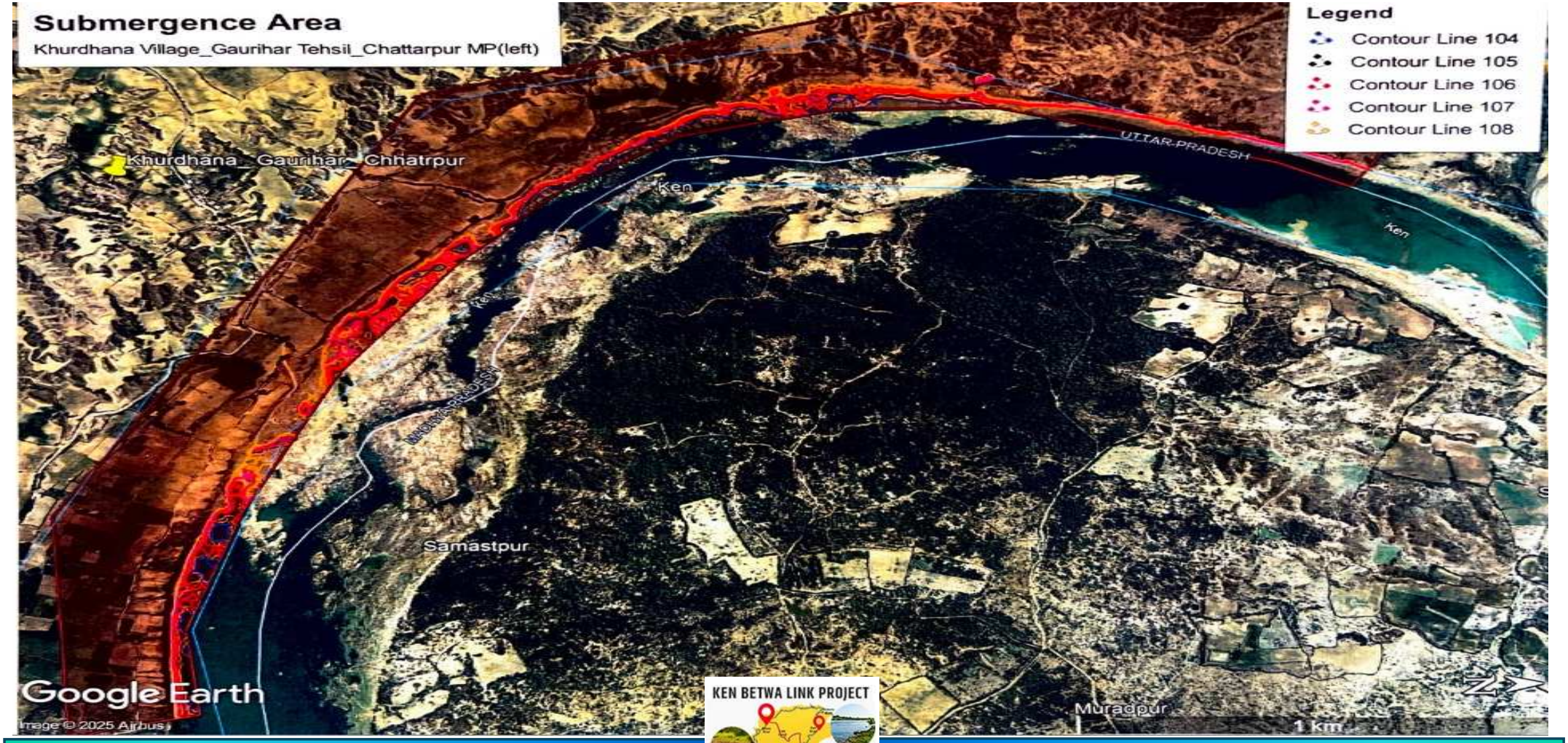


# 7. Thakura (MP)

## Left Side

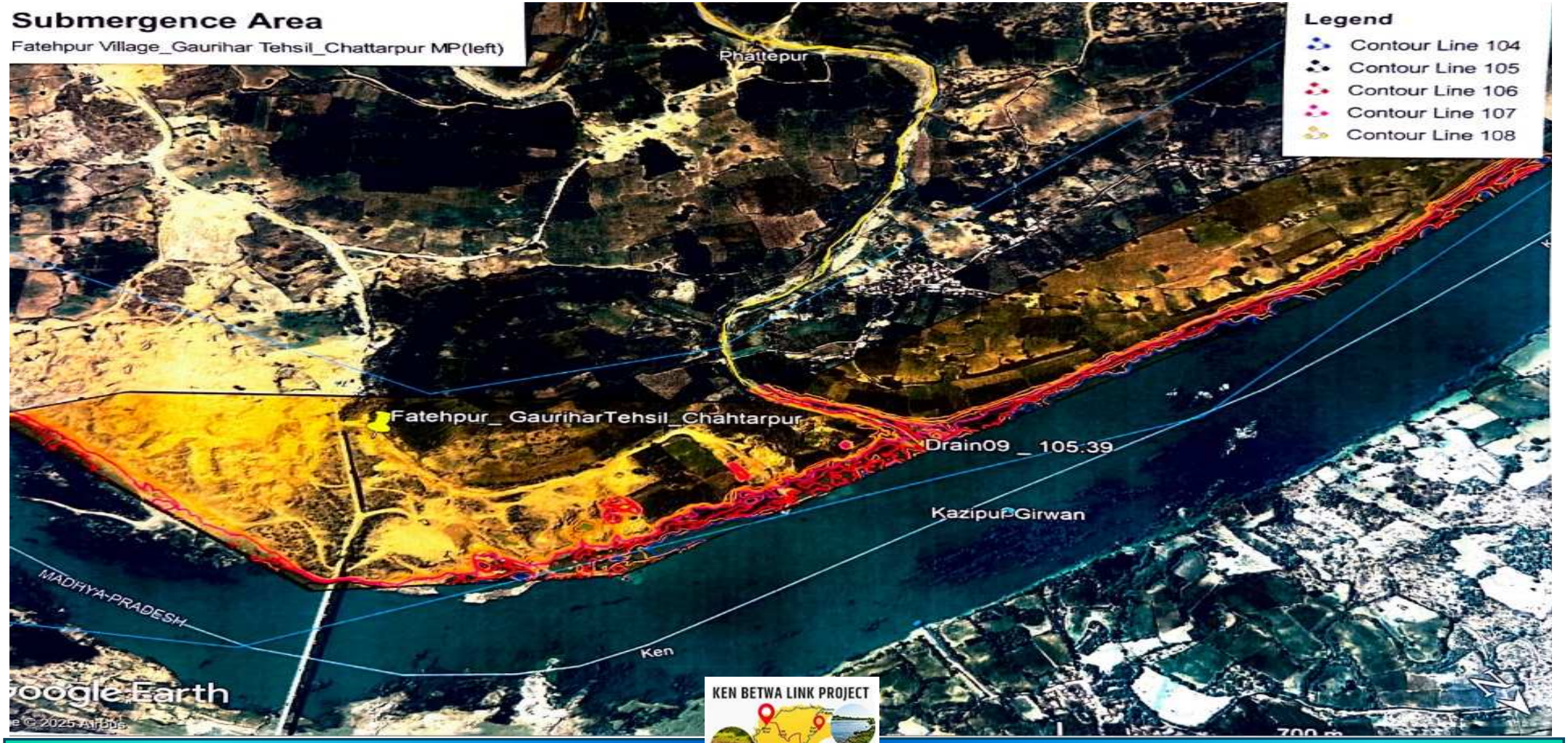
# 8. Khurdana (MP)

# Left Side

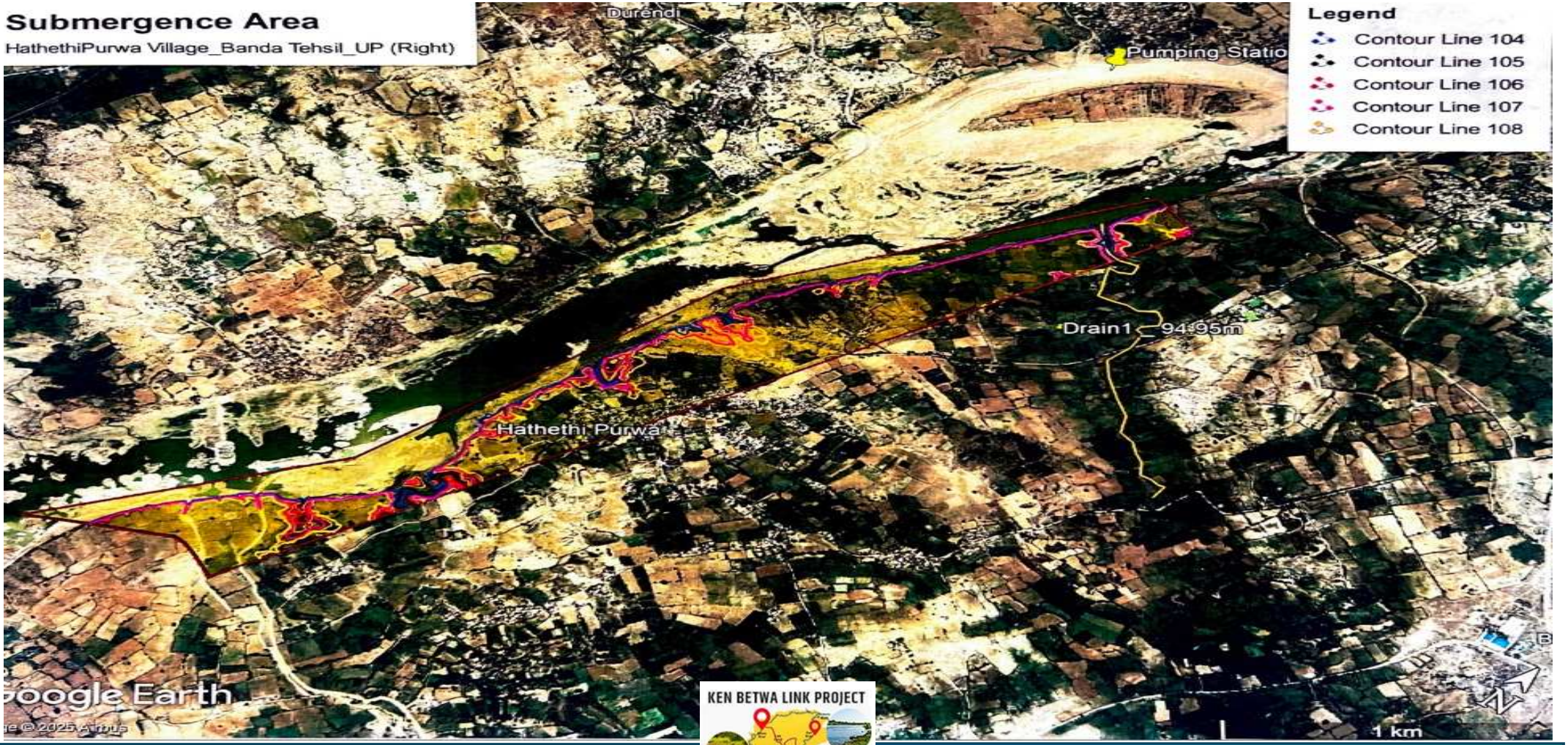


# 9. Fatehpur (MP)

# Left Side

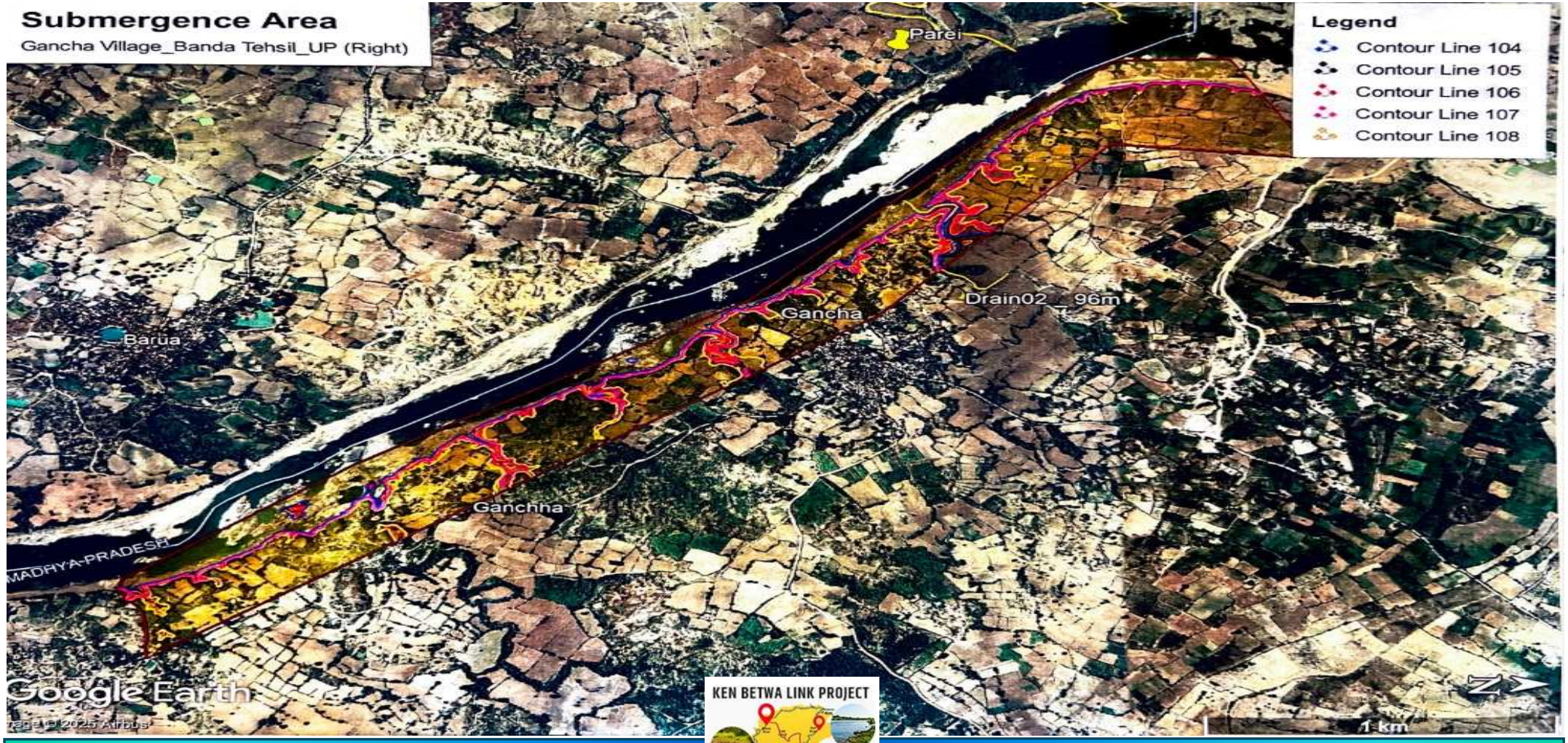


# 1. Hatheti Purwa (UP) Right Side



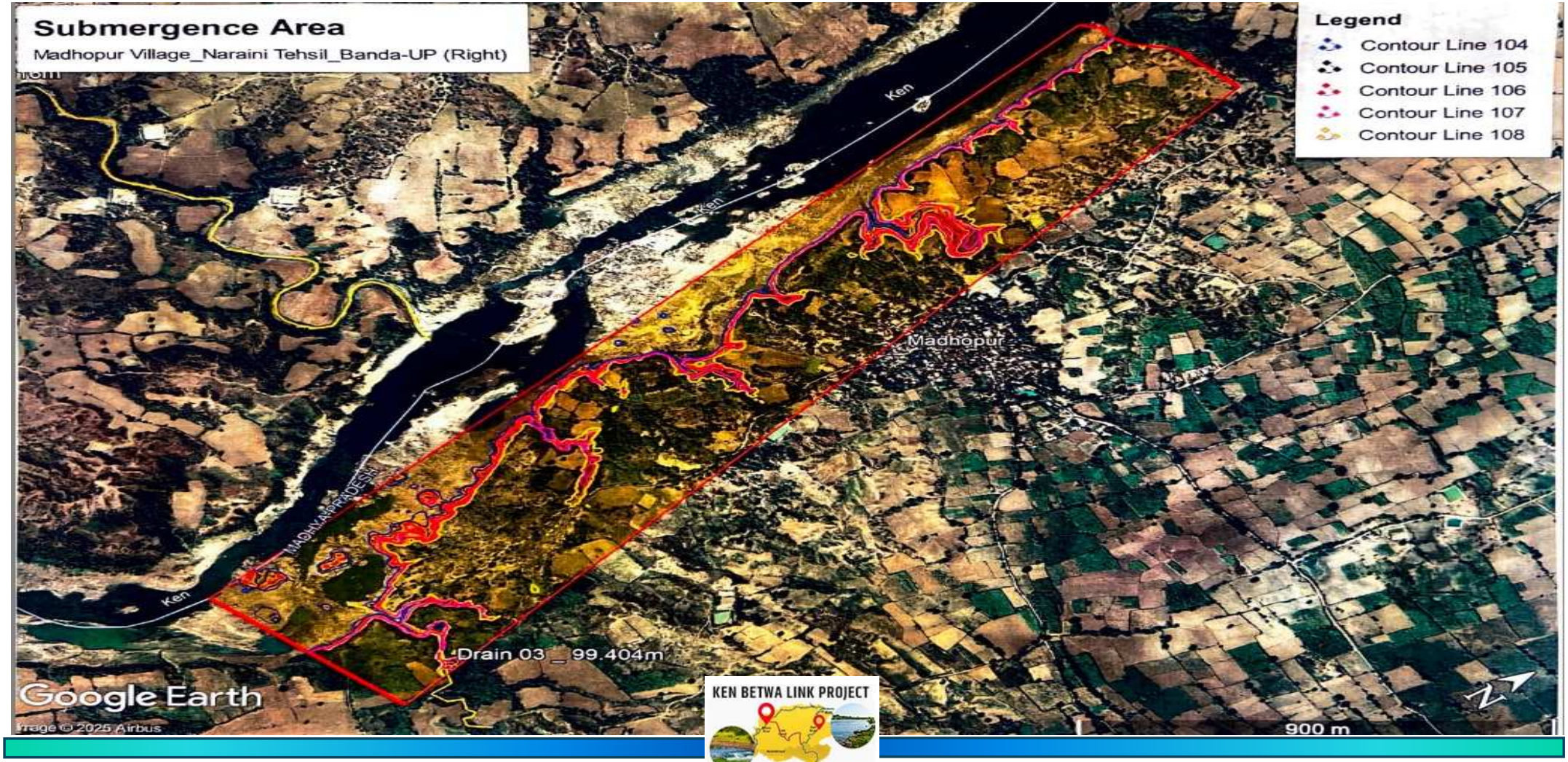
# 2. Gancha (UP)

# Right Side



# 3. Madhopur (UP)

# Right Side

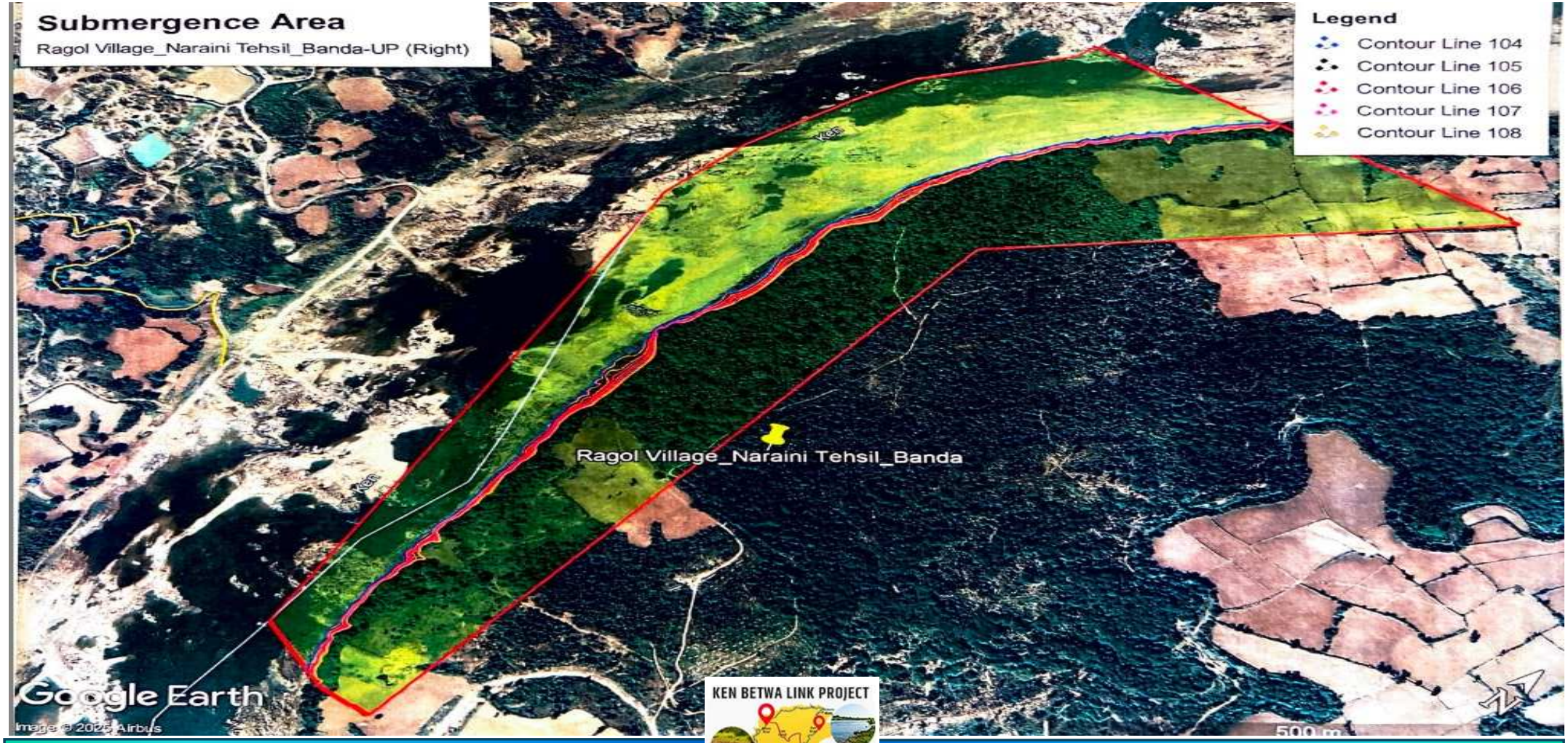


# 4. Manipur(UP)

# Right Side

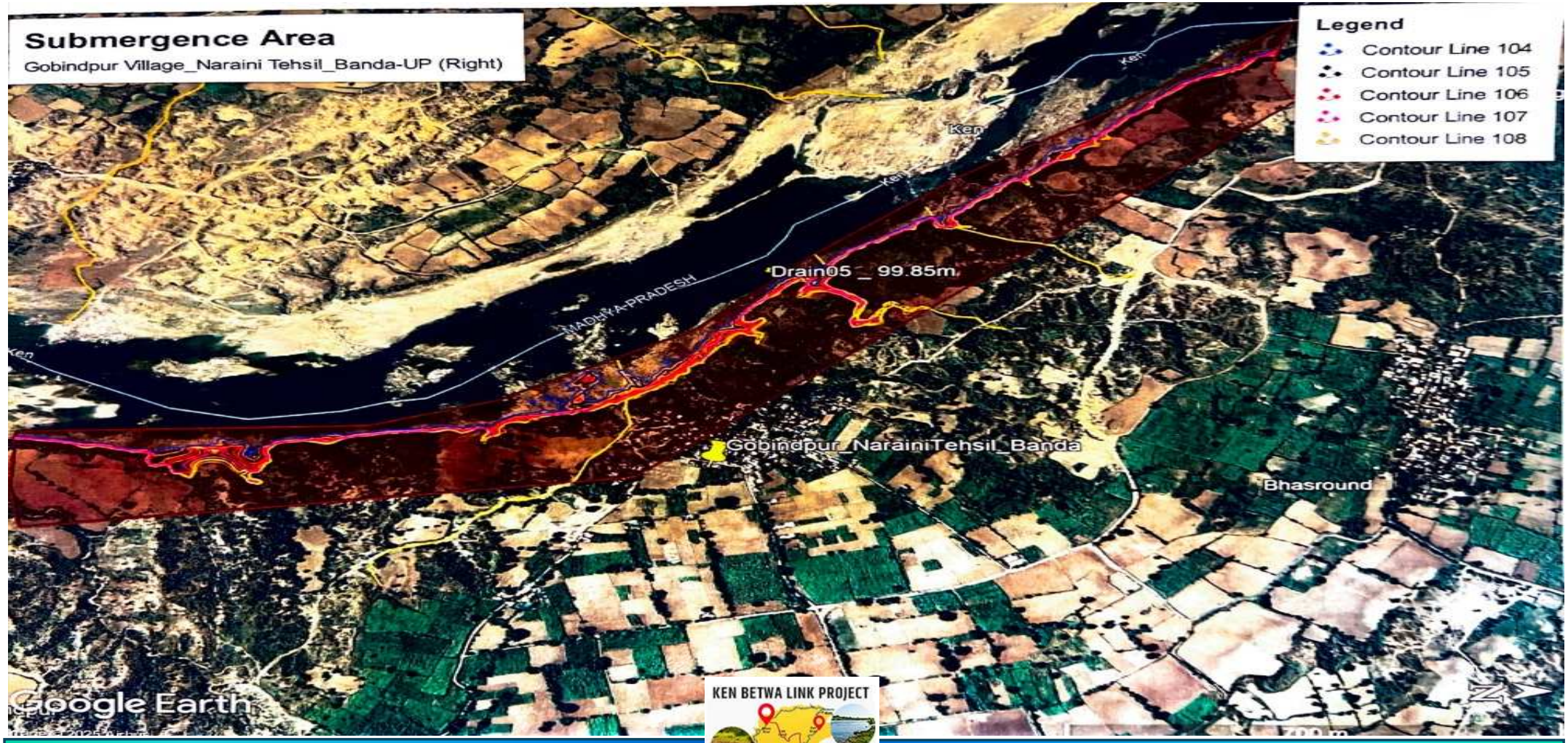
# 5. Ragol (UP)

# Right Side



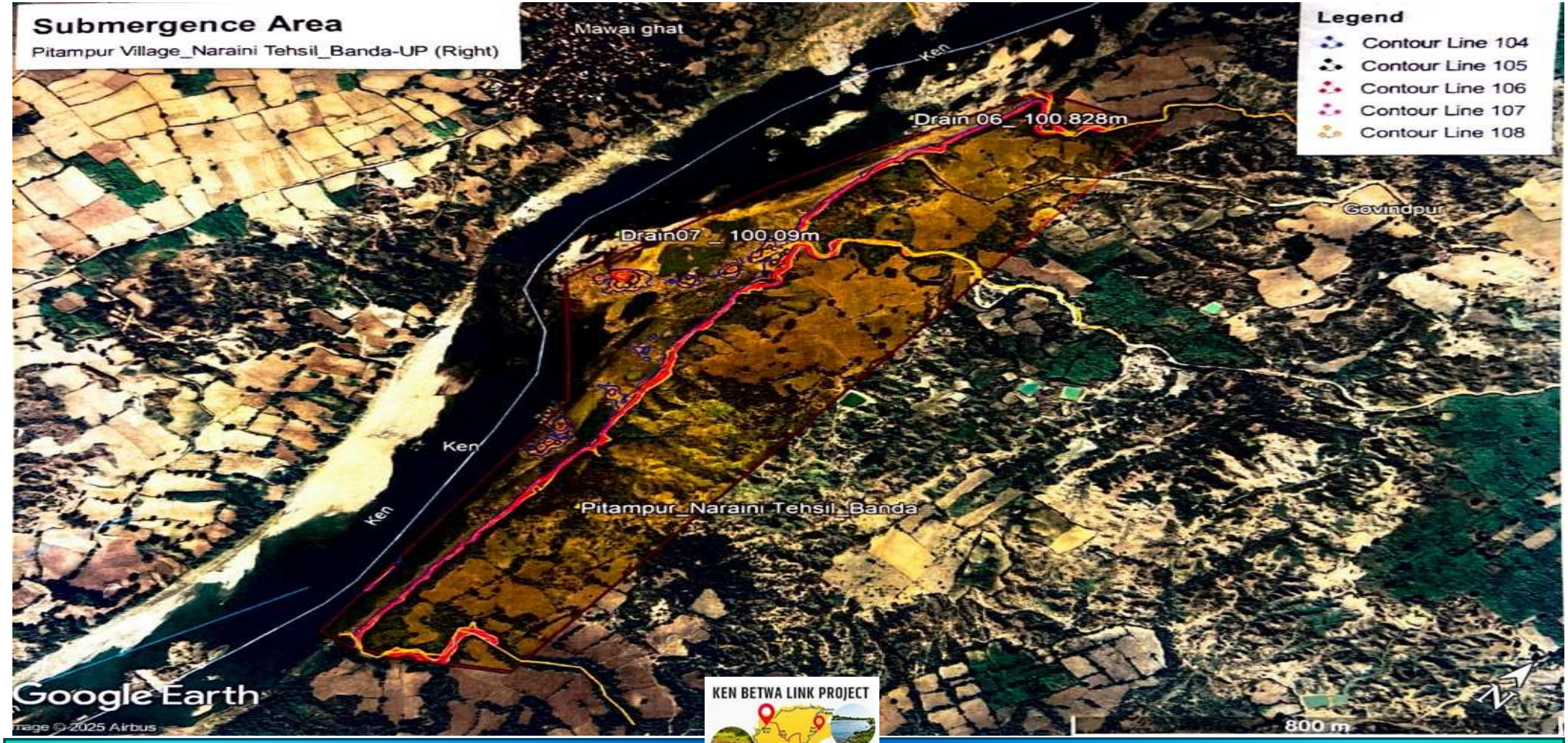
# 6. Gobindpur (UP)

# Right Side



# 7. Pitampur Jarar (UP)

# Right Side

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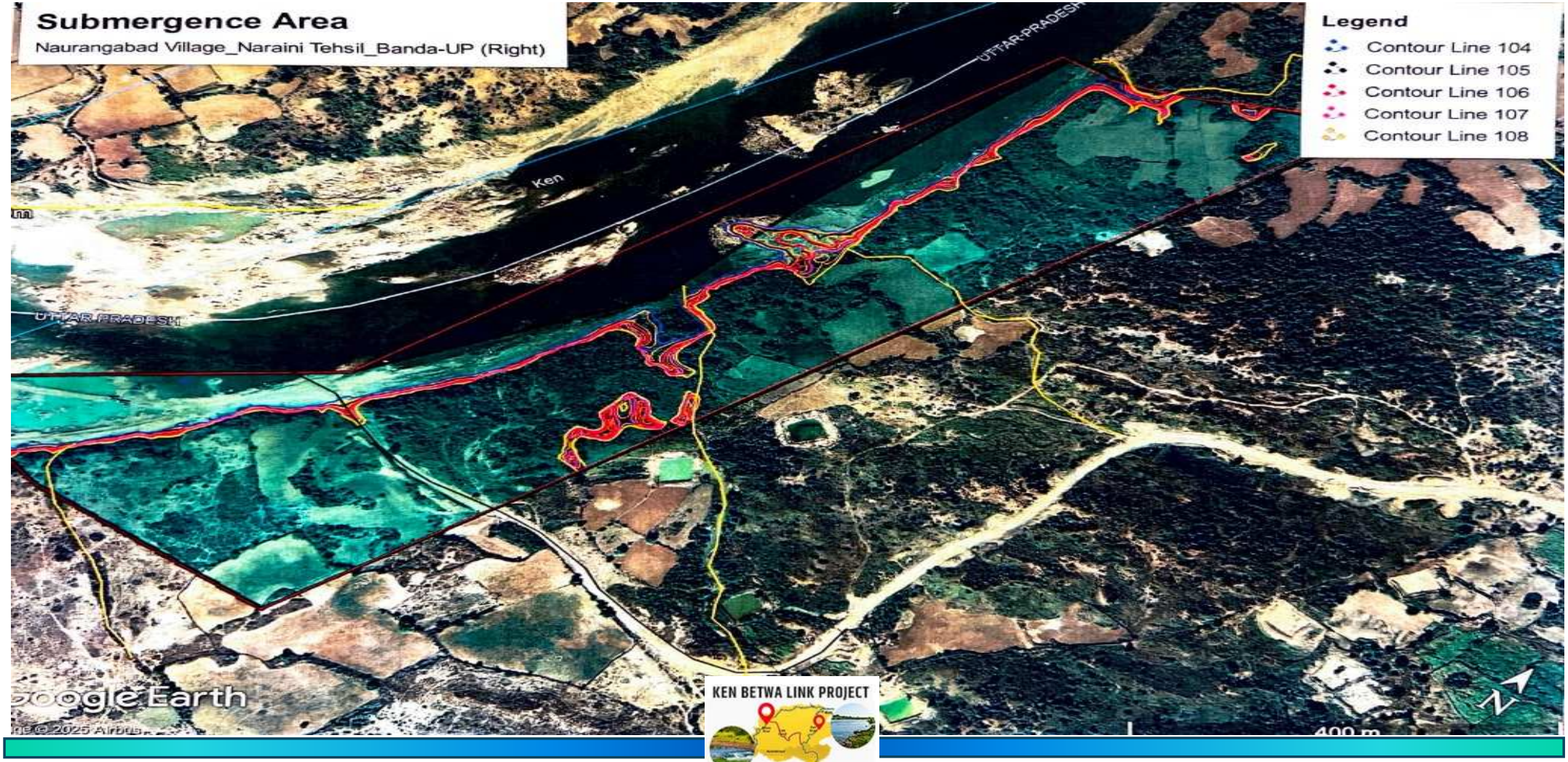
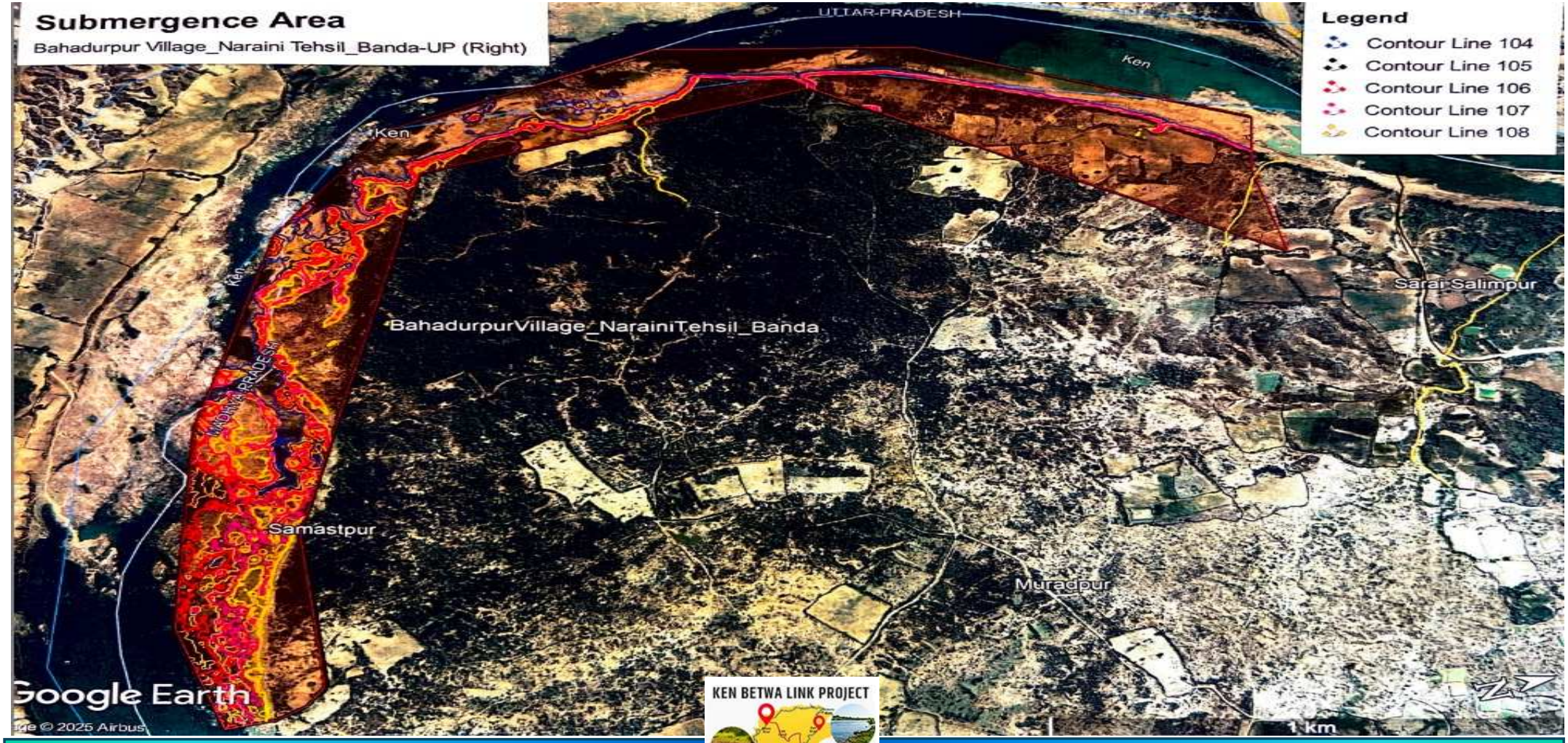
# 8. Naurangabad (UP)

# Right Side



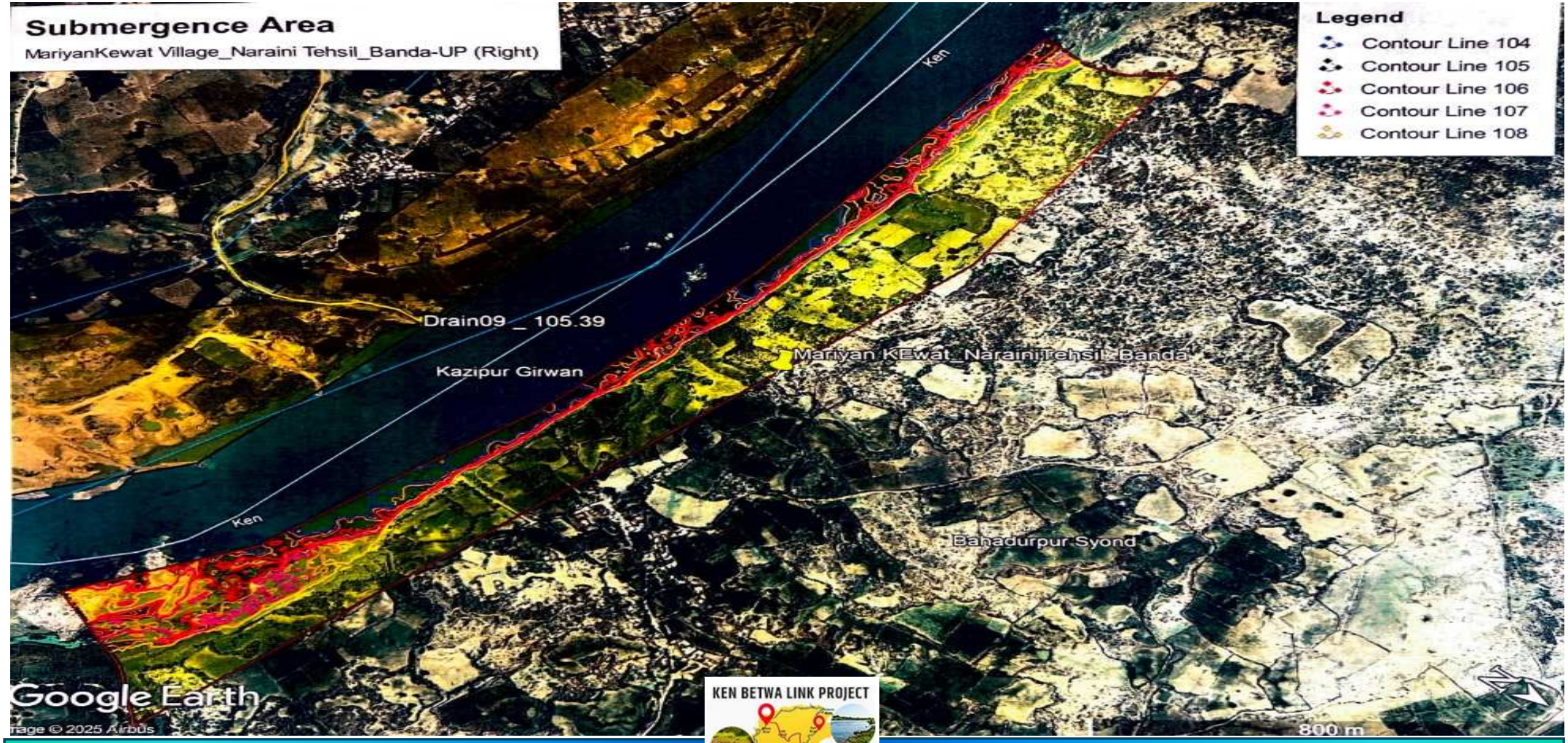
# 9. Bahadurpur (UP)

# Right Side



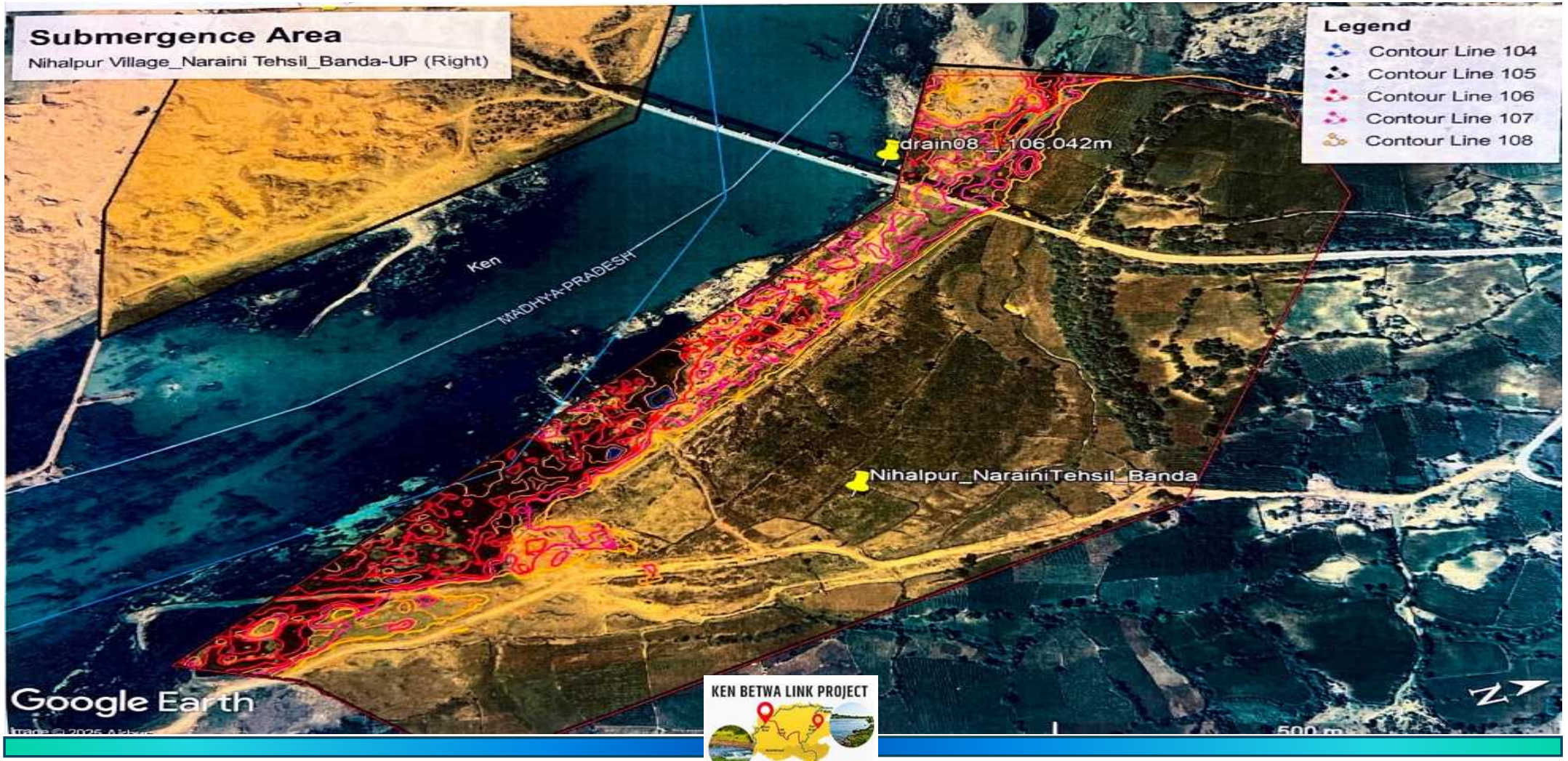
# 10. Mariyan Kewat (UP)

# Right Side



# 11. Nihalpur (UP)

# Right Side



सिंचनेन समृद्धि भवति

# Thank You