

Unveiling the Hidden Depths: Mapping Subsurface Lithology of the Karnali Megafan in Nepal using Resistivity Survey



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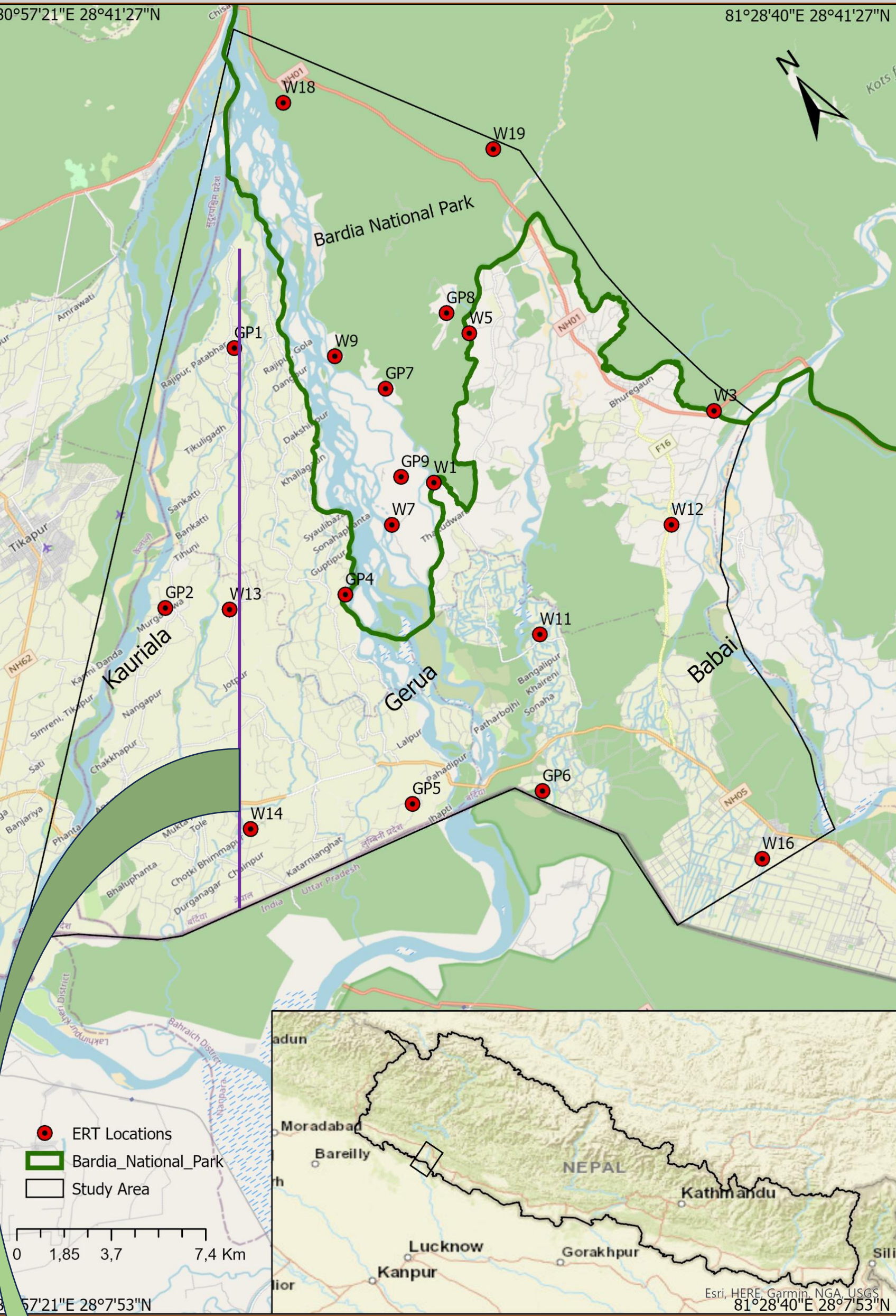
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CONTEXT

Karnali megafan is at the foot of the Himalayas in southwestern Nepal. Bardia National Park where tigers, elephants and rhinoceros roam, partially overlaps with the megafan. Water stress is expected to increase yet detailed information on aquifer systems is lacking. This study aims to lithologically schematize the area using a resistivity survey.



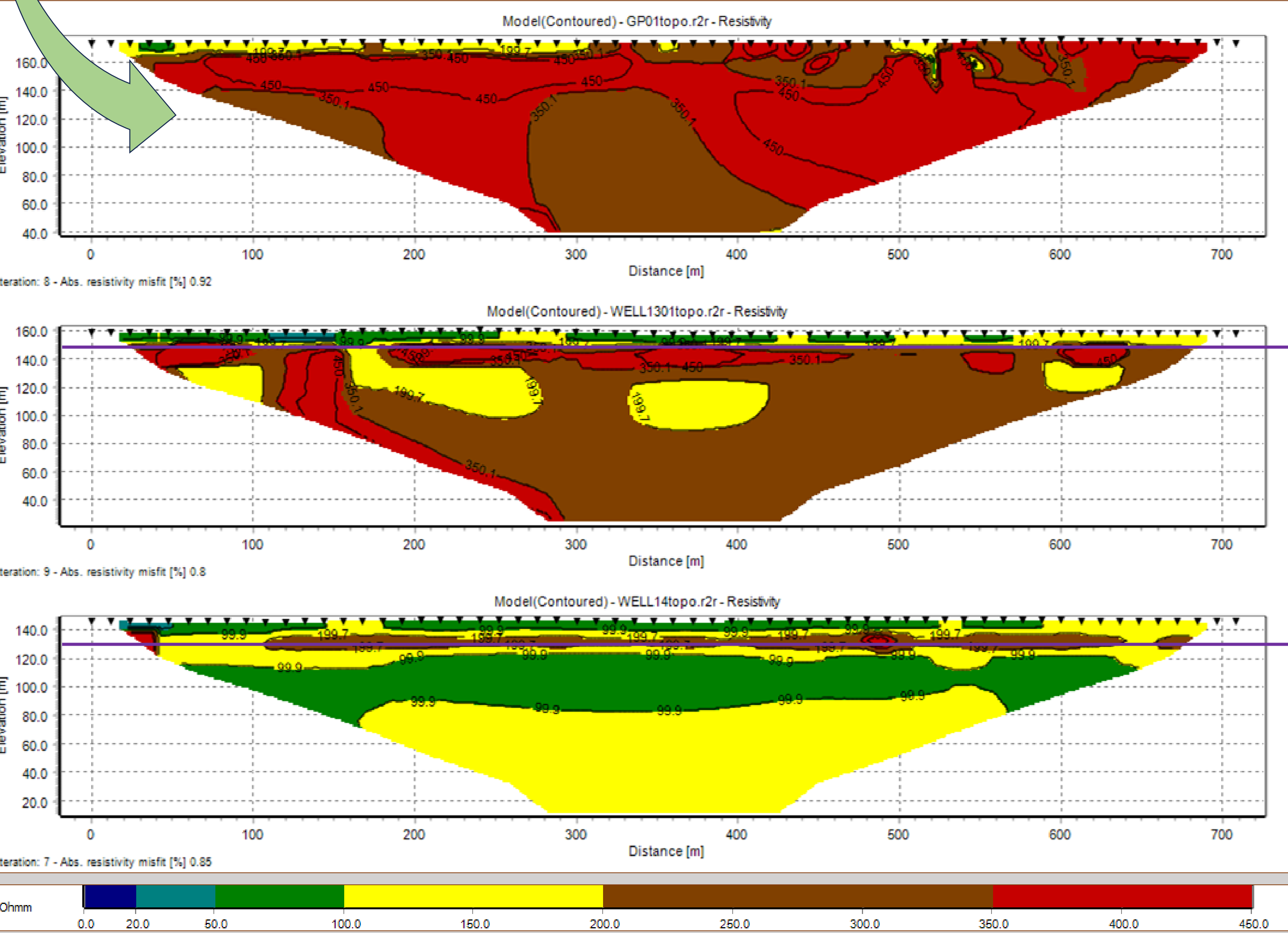
PRINCIPLE and METHOD

Electrical Resistivity Tomography (ERT) Injection of electrical current into ground and measurement of potential difference by arranging electrodes in different configurations

$$\rho = \frac{V}{I} 2\pi r$$

ρ = apparent resistivity, r = distance between electrodes, V = voltage, I = current

- Data acquisition using Geomative GD-10 multi-electrode system
- Two types of profiles collected using Wenner configuration: a. 18 profiles: 710 m length, depth 100 m, electrode spacing 12 m and b. 3 profiles: 510 m length, depth 50 m, electrode spacing 5 m
- Inversions performed using Res2DInv with robust constraint optimization
- Residual mean square error of 5% used as cut-off value to attain convergence (Loke, 2001)
- 2D sections showing resistivity of sedimentological layers are obtained. They are presented in a scale of 0-450 Ω m to enable intercomparison
- Lithology of layers interpreted by comparing with resistivity of sediments in Nepal (Shrestha et al., 2013) and borehole descriptions



W13	
160.0	Silt – fine sand
157.0	
155.6	Sand with gravel
155.0	Sand
154.0	Gravel

W14	
140.0	Silt – fine sand
137.5	
137.0	Sand with gravel
135.2	Sand
133.0	Gravel

GP1, W13, W14

FUTURE WORK

- Construct 3D lithological model using the 2D profiles showing aquifer and aquitard layers
- Use it for groundwater modeling and scenario analysis

RESULT

Along line shown (N-S)

- The sediments in the north are coarse grained sand, boulders, gravels
- These are results of weathering and deposition of sedimentary rocks from Shivalik hills. This zone (Bhabar) leads to direct infiltration of precipitation to the groundwater (Government of Nepal, 2015; Shrestha, 1992)
- Sediments turn finer from north to south as expected; a silt layer appears between 20-60 m depth in the south
- The hydrological basis has not been reached

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