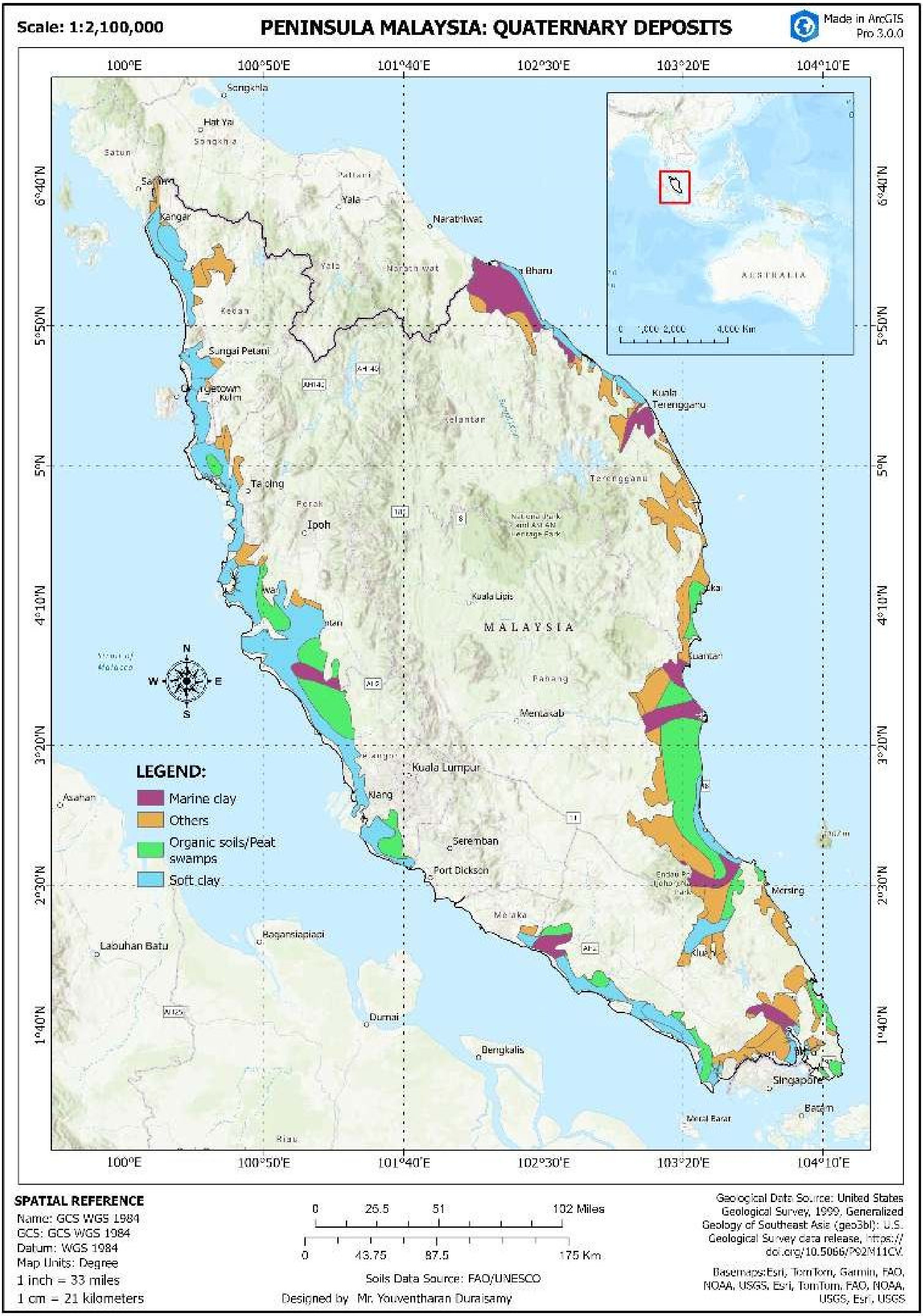
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PENINSULA MALAYSIA: QUATERNARY DEPOSITS
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GCS: GCS WGS 1984
Datum: WGS 1984
Map Units: Degree
1 inch = 33 miles
1 cm = 21 kilometers
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0 43.75 87.5 175 Km
Soils Data Source: FAO/UNESCO
Designed by Mr. Youventharan Duraisamy
Geological Data Source: United States Geological Survey, 1999. Generalized Geology of Southeast Asia (geo3bl): U.S. Geological Survey data release, https://doi.org/10.5066/P92M11CV.
Basemaps:Esri, TomTom, Garmin, FAO, NOAA, USGS, Esri, TomTom, FAO, NOAA, USGS, Esri, USGS

Experts

Malaysia’s ECRL Project: A Marvel in Motion or a Disaster in Waiting?

15 December 2025

As Malaysia advances its transportation infrastructure to align with its economic ambitions, the East Coast Rail Link (ECRL) stands as a symbol of progress, a high-speed connection meant to bridge the east and west coasts of Peninsular Malaysia. Set to commence full operations in 2027, the ECRL promises faster logistics, economic integration, and regional upliftment. However, beneath this steel-and-concrete marvel lies a far less glamorous truth: the environmental and geotechnical implications that could spell long-term consequences for the very soil it stands on.

While the economic benefits are widely touted, the engineering and environmental communities are voicing growing concerns about the ECRL’s path through highly sensitive terrain, particularly the collapsible soil zones and residual tropical formations that define much of the East Coast region. Left unmitigated, these geotechnical challenges could trigger not only excessive settlement but also widespread slope failures and infrastructure vulnerability.

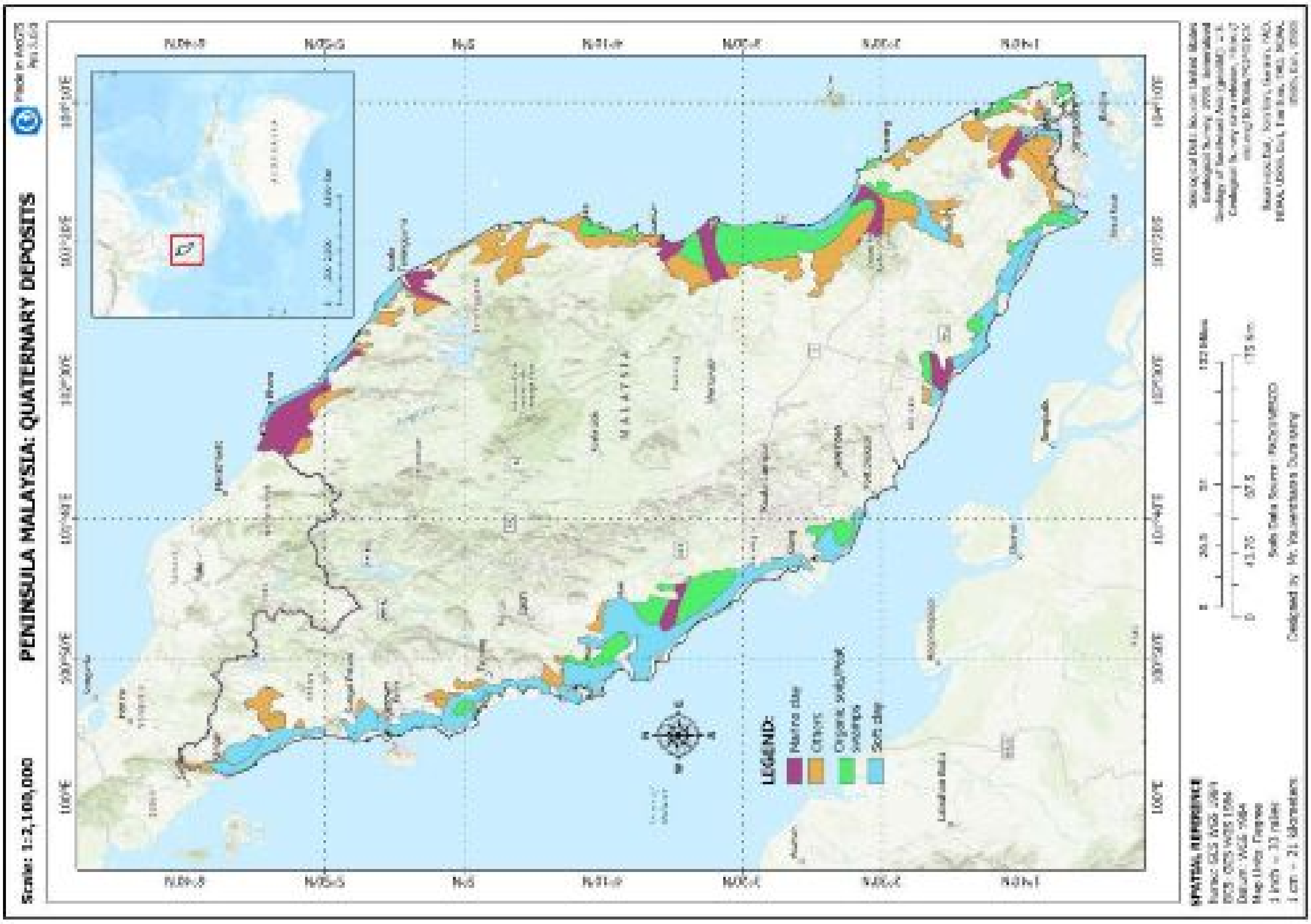

Figure 1: Roughly scattered view of problematic soil in Peninsular Malaysia

Understanding the Terrain: A Fragile Foundation

The East Coast is underlain by extensive zones of collapsible soils, which, though stable in their natural dry condition, lose strength dramatically when saturated. When loaded with structural weight such as rail infrastructure and subjected to moisture fluctuations due to monsoon patterns or climate change, these soils are prone to sudden and uneven settlement.

Residual soils, commonly found in the hilly terrains of Terengganu, Kelantan, and Pahang, are also highly variable in strength and prone to slope instability when disturbed by earthworks or deforestation. Rail alignments cutting through such terrain can act as triggers for deep-seated landslides, especially when compounded by improper drainage or unsupervised slope cuts.

Historical Events and their significance

1. Batang Kali Landslide (December 2022):
- A slope failure from the road embankment buried a campsite near Genting Highlands.
- Involved ~450,000 m3 of soil, killing 31 people.
- Triggered by heavy rainfall; reinforced need for slope mapping and maintenance.
2. Genting–Batang Kali & Genting Sempah Roads:
- Historical landslides (1995: 20 deaths, 2014: closure from slope failure).
- Shows embankments over collapsible soils are risky—like those planned for ECRL.

Environmental Disruption Beyond the Rails

The issue is not purely geotechnical. Large-scale transportation projects bring with them an ecological cost, one that includes:

- Clearing of forest reserves, disrupting biodiversity corridors,
- Sediment runoff into rivers, harming aquatic ecosystems and increasing siltation,
- Altered hydrology, increasing flood risks downstream.

In particular, some portions of the ECRL alignment cut through water catchment zones and protected forests, potentially displacing endemic species and threatening Malaysia's already vulnerable natural heritage. Construction near highlands or karst areas may even open sinkholes or create irreversible changes to groundwater flow.

Table 1: Key Locations and Characteristics of Collapsible Soils in Peninsular Malaysia*

State	Geological setting	Soil type	Characteristics	Engineering concerns
Pahang	Alluvial plains, residual granite soils	Silty sand, lateritic soils	High void ratio; collapses when saturated	Settlement risk for ECRL embankments
Terengganu	Coastal alluvium	Loose sand, silts	Rapid loss of strength after rain	Embankment instability
Kelantan	Floodplain alluvium	Silty sand	Moisture-sensitive; monsoon impact	Differential settlement

*based on available data and the personal experience of the author.

Are We Engineering with Nature — Or Against It?

Malaysia has the talent and tools to build sustainably. What we lack is often the policy enforcement and early-stage geotechnical integration into mega-project planning. In the case of ECRL, the pressing question is: Have enough soil investigations, slope hazard mapping, and hydrological studies been conducted and, more importantly, acted upon?

Time and again, we have seen the cost of hindsight. The Highland Towers tragedy, the Bukit Kukus landslide, and the recent sinkholes in urban areas, such as the Masjid India incident, remind us that engineering oversight on unstable ground is not merely a design error, but it is a life-threatening gamble.

Engineering Recommendations That Must Not Be Ignored

To avoid the ECRL becoming an environmental time bomb, it is critical that:

1. Detailed Geotechnical Risk Assessment be mandatory along the entire alignment, especially in

known collapsible soil areas.

2. Slope Stability Monitoring Systems be installed with real-time alerts during and post-construction.
3. Advanced Ground Improvement Techniques, such as dynamic compaction, soil replacement, or deep soil mixing, be deployed where required.
4. Environmental Impact Assessments (EIA) be continuously updated — not just pre-construction but during operations.
5. Transparent public reporting on environmental mitigation strategies to restore public trust and allow academic scrutiny.
6. Collapsible Soil Map must be produced by the relevant authorities as guidance to local government and town planners to propose any mitigation actions.

Balancing Progress and Responsibility

No one is disputing the potential economic merits of the ECRL. However, responsible engineering must account for not just the structure, but the substrate, the ecosystem, and the communities it affects. Short-term progress cannot come at the cost of long-term environmental degradation and structural failure.

If the government and contractors act now proactively, transparently, and with scientific diligence, the ECRL can still be a beacon of sustainable development. Without serious reconsideration of the geotechnical and ecological concerns, we risk building not a railway of the future, but a costly reminder of what happens when we move too fast and think too little about the ground beneath our feet.

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