Bengaluru's Hebbal tunnel raises concerns about groundwater and flooding

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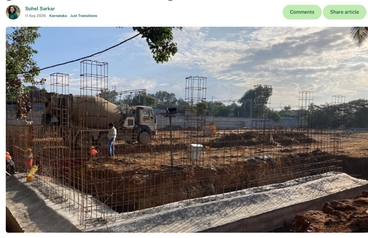

- *The proposed Hebbal tunnel is intended to ease one of north Bengaluru's major traffic bottlenecks, but its long-term congestion benefits remain uncertain.*
- *Its alignment near Hebbal Lake has raised concerns over flooding, groundwater recharge and the loss of lake buffer space.*
- *While the project's DPR proposes engineering measures to manage water, experts say their effectiveness will depend on the functioning of the wider lake and stormwater system.*

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The proposed three-lane, bidirectional tunnel road in north Bengaluru, intended to ease congestion at Hebbal Junction — a major interchange connecting the airport with the rest of the city — has run into rough weather.

At an estimated ₹1,385 crores (₹13.85 billion), the tunnel will cost about ₹622 crore (₹6.22 billion) per kilometre. The tunnel's long-term benefits in terms of easing traffic congestion are, however, unclear.

A recent analysis by the Sustainable Transportation Lab of the Indian Institute of Science (IISc) points out that the tunnel is a "highly localised improvement" that "merely shifts the congestion point", leaving bottlenecks at its entry and exit. The detailed project report or DPR shows that by 2047, the tunnel will operate at or beyond capacity in all scenarios modelled.

According to urban mobility expert Satya Arikutharam, apart from creating more chaos at these bottlenecks, the tunnel "will also worsen the local traffic, the very problem it intends to solve. Faster arrival rate at these local road intersections due to the new short tunnel capacity means quicker accumulation of traffic, queuing pile-ups and traffic jams," he says.

Groundwater and flooding concerns

A bigger concern the citizens and environmental experts are raising is about the risks it could pose to groundwater and flooding.

The little over two-kilometre tunnel will run from the Hebbal flyover junction in north Bengaluru — about 30 km by road from Kempegowda International Airport — through the Gandhi Krishi Vigyana Kendra (GKVK) campus of the University of Agricultural Sciences and end at the Karnataka Veterinary, Animal and Fisheries Sciences University (KVAFSU). Part of its proposed alignment will lie within metres of Hebbal Lake, a 141-acre water body that, experts say, is critical for groundwater recharge and flood mitigation in the region.

A public interest litigation filed in the Karnataka High Court argues that the project is being implemented without a hydrological or groundwater impact assessment, or lake study. The PIL seeks a stay on the project.

Grounds being cleared for tunnel construction, which will cost an estimated ₹1,385 crores. However, its long-term benefits are unclear; a recent analysis points out that the tunnel will merely shift the congestion point, leaving bottlenecks at its entry and exit. Image by Sohel Sarkar

Acting on this petition, the court, on August 6, directed the state to file an affidavit clarifying if any studies have been conducted to understand the impact of the project on the Hebbal Lake. The court specifically sought information on whether the tunnel would cause any obstruction to the inflow and outflow of the water or disrupt any natural aqueduct or underground flow of water.

Subsequently, at a September 3 hearing, the court, that noted that a geotechnical report before it states that the lake's inflow and outflow would not be affected, directed the state to arrange a presentation by an engineer explaining the measures taken to ensure that the lake's inflow and outflow are not obstructed.

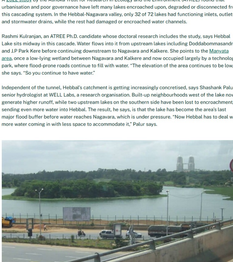
Yashwantha Kumar M., executive engineer at the Bangalore Development Authority (BDA), which is executing the project, informs Mongabay-India that the BDA has undertaken hydrological studies as part of the project. He, however, did not provide details of what these studies assessed. "The BDA has filed a detailed response before the court to the hydrological questions raised in the petition," he adds. This filing, however, is not publicly available.

The DPR has earmarked ₹75 lakh (₹7.5 million) for an environmental impact assessment. But no such assessment has been made available to the public, even as groundwork for the project, according to Kumar, began in the KVAFSU campus in early August.

Kumar describes the ₹75 lakh as "just a budgetary provision" that "can be done at any time". As a standalone 2.2-km tunnel, the project does not fall under the category of projects for which environmental impact assessment is mandatory to obtain central government permission, he adds.

Earlier, the Union environment ministry clarified that a standalone tunnel does not automatically require prior environmental clearance under the Environmental Impact Assessment Notification, 2006, as tunnel projects are not listed in its Schedule. If a tunnel forms an integral part of a highway project covered by the notification, the highway project, including the tunnel, would require environmental appraisal.

The DPR admits that Hebbal junction and its surrounding areas are prone to urban flooding due to inadequate stormwater capacity and backflow from the lake, and that existing stormwater drains are insufficient to carry peak monsoon discharge.



Hebbal Flyover flanked by Hebbal and Nagawara lakes on either side. Map via Google Earth.

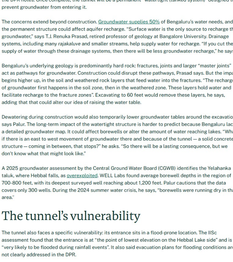
A lake system already under strain

Bengaluru's lakes are a part of a centuries-old engineered system built by damming the city's undulating valleys to harvest rainwater in a region with no perennial river. This evolved into a network of interconnected lakes linked by stormwater drains or rajakaluve, allowing water to flow from one lake to the next across the city's three principal valleys.

A 2022 study by the Ashoka Trust for Research in Ecology and the Environment (ATREE) found that urbanisation and poor governance have left many lakes encroached upon, degraded or disconnected from this cascading system. In the Hebbal-Nagawara valley, only 32 of 72 lakes had functioning inlets, outlets and stormwater drains, while the rest had damaged or encroached water channels.

Rashmi Kulranjan, an ATREE Ph.D. candidate whose doctoral research includes the study, says Hebbal Lake sits midway in this cascade. Water flows into it from upstream lakes including Doddabommanahalli and J.P Park Kere before continuing downstream to Nagavara and Kalkere. She points to the Manyata area, once a low-lying wetland between Nagavara and Kalkere and now occupied largely by a technology park, where flood-prone roads continue to fill with water. "The elevation of the area continues to be low," she says. "So you continue to have water."

Independent of the tunnel, Hebbal's catchment is getting increasingly concretised, says Shashank Palur, senior hydrologist at WELL Labs, a research organisation. Built-up neighbourhoods west of the lake now generate higher runoff, while two upstream lakes on the southern side have been lost to encroachment, sending even more water into Hebbal. The result, he says, is that the lake has become the area's last major flood buffer before water reaches Nagavara, which is under pressure. "Now Hebbal has to deal with more water coming in with less space to accommodate it," Palur says.



Hebbal Lake photographed in 2008. Image by V. Malik via Wikimedia Commons (CC BY-SA 2.0).

What the tunnel could do underground

The DPR acknowledges the hydrological sensitivity of Hebbal Lake. The proposed tunnel will be built using the "cut-and-cover method", involving excavation to 18.5 metres (60 feet), construction of the tunnel and covering it over, rather than boring through rock.

During construction, stormwater drains in the tunnel's path may need to be temporarily diverted to prevent flooding of the excavation pit. Temporary barriers or cofferdams, will keep water out, particularly during the monsoon, while groundwater may need to be continuously pumped out through dewatering, the DPR notes. Once complete, the tunnel will be a permanent "waterright (tanked system)" designed to prevent groundwater from entering it.

The concerns extend beyond construction. Groundwater supplies 50% of Bengaluru's water needs, and the permanent structure could affect aquifer recharge. "Surface water is the only source to recharge the groundwater," says T.J. Renuka Prasad, retired professor of geology at Bangalore University. Drainage systems, including many rajakaluve and smaller streams, help supply water for recharge. "If you cut the supply of water through these drainage systems, then there will be less groundwater recharge," he says.

Bengaluru's underlying geology is predominantly hard rock: fractures, joints and larger "master joints" act as pathways for groundwater. Construction could disrupt these pathways, Prasad says. But the impact begins higher up, in the soil and weathered rock layers that feed water into the fractures. "The recharge of groundwater first happens in the soil zone, then in the weathered zone. These layers hold water and facilitate recharge to the fracture zones". Excavating to 60 feet would remove these layers, he says, adding that that could alter our idea of raising the water table.

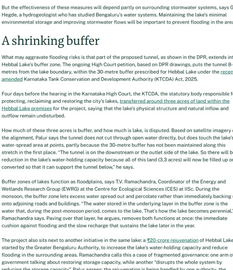
Dewatering during construction would also temporarily lower groundwater tables around the excavation, says Palur. The long-term impact of the watertight structure is harder to predict because Bengaluru lacks a detailed groundwater map. It could affect borewells or alter the amount of water reaching lakes. "What if there is an east to west movement of groundwater there and because of the tunnel — a solid concrete structure — coming in between, that stops?" he asks. "So there will be a lasting consequence, but we don't know what that might look like."

A 2025 groundwater assessment by the Central Ground Water Board (CGWB) identifies the Yelahanka taluk, where Hebbal falls, as overexploited. WELL Labs found average borewell depths in the region of 700-800 feet, with its deepest surveyed well reaching about 1,200 feet. Palur cautions that the data covers only 300 wells. During the 2024 summer water crisis, he says, "borewells were running dry in that area."

The tunnel's vulnerability

The tunnel also faces a specific vulnerability: its entrance sits in a flood-prone location. The IISc assessment found that the entrance is at "the point of lowest elevation on the Hebbal Lake side" and is "very likely to be flooded during rainfall events". It also said evacuation plans for flooding conditions are not clearly addressed in the DPR.

Palur says established engineering solutions, including pumps, can keep water out of underground structures. "I don't think overland flooding will have that much of an impact on the subsurface structures."



The tunnel also faces a specific vulnerability: its entrance sits in a flood-prone location. Image by Sohel Sarkar.

The DPR proposes a watertight tunnel with continuous drainage to collect groundwater seepage, rainwater and other water entering the structure and pump it into municipal drains. The tunnel portals will also have flood barriers and sump pumping systems, while the ramps will have canopies, side drains and sumps to manage rainwater.

But the effectiveness of these measures will depend partly on surrounding stormwater systems, says G.V. Hegde, a hydrogeologist who has studied Bengaluru's water systems. Maintaining the lake's minimal environmental storage and improving stormwater flows will be important to prevent flooding in the area.

A shrinking buffer

What may aggravate flooding risks is that part of the proposed tunnel, as shown in the DPR, extends into Hebbal Lake's buffer zone. The ongoing High Court petition, based on DPR drawings, puts the tunnel 8-12 metres from the lake boundary, within the 30-metres buffer prescribed for Hebbal Lake under the recently amended Karnataka Tank Conservation and Development Authority (KTCDA) Act, 2025.

Four days before the hearing in the Karnataka High Court, the KTCDA, the statutory body responsible for protecting, reclaiming and restoring the city's lakes, transferred around three acres of land within the Hebbal Lake premises for the project, saying that the lake's physical restoration and natural inflow and outflow remain undisturbed.

How much of these three acres is buffer, and how much is lake, is disputed. Based on satellite imagery of the alignment, Palur says the tunnel does not cut through open water directly, but does touch the lake's water-spread area at points, partly because the 30-metre buffer has not been maintained along this stretch in the first place. "The tunnel is on the downstream or the outlet side of the lake. So there will be reduction in the lake's water holding capacity because all of this land (3.3 acres) will now be filled up or converted so that it can support the tunnel below," he says.

Buffer zones of lakes function as floodplains, says T.V. Ramachandra, Coordinator of the Energy and Wetlands Research Group (EWRG) at the Centre for Ecological Sciences (CES) at IISc. During the monsoon, the buffer zone lets excess water spread out and percolate rather than immediately backing up into adjoining roads and buildings. "The water stored in the underlying layer in the buffer zone is the water that, during the post-monsoon period, comes back into the lake. That's how the lake becomes perennial," Ramachandra says. Paving over that layer, he argues, removes both functions at once: the immediate cushion against flooding and the slow release that sustains the lake later in the year.

The project also sits next to another initiative in the same lake: a ₹20-crore rejuvenation of Hebbal Lake, started by the Greater Bangalore Authority, to increase the lake's water-holding capacity and reduce flooding in the surrounding areas. Ramachandra calls this a case of fragmented governance: one arm of government talking about restoring storage capacity, while another "disrupts the whole system by reducing the storage capacity." Palur agrees the rejuvenation is being handled by one authority, the tunnel by another, and "they don't necessarily talk to each other," even though both ultimately report to the same government.

The question, then, is not just whether the tunnel would be effective, but whether the city can afford to gamble on an infrastructure project whose long-term impacts remain uncertain. The Hebbal project also exposes the consequences of planning roads and waterbodies as separate systems.

Banner image: The construction site of the Hebbal short tunnel. Image by Sohel Sarkar.

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