

Ground Water Problem of Jodhpur

- Solution to address a Manmade Disaster



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1. Background

Jodhpur was suffering from major water shortage till early 1990s, when the water from Punjab through the **Indira Gandhi Canal**, and thereafter by the **Rajiv Gandhi Canal** reached water to the city. Sociological changes happened thereon – people of the city of Jodhpur used the canal water (which became easily available in taps in each house) in place of drawing water from traditional wells spread throughout the city. Alongside, the city did not develop the mechanisms to take the storm water, waste water and sewage from each household and treat them – even today most of the water is left into the ground. Over the last two decades of getting the canal water, the ground water table has risen – at an alarming rate of about 1m per year in some places, and lesser in some. But, for sure, the ground water is polluted with sewage. Numerous test of ground water quality at different locations have established this emphatically – in many cases, the contamination of Nitrates, Fluorides, Sulphates and Phosphates (from the sewage) are well beyond acceptable levels. It is a matter of loss of human dignity in the city of Jodhpur... with sewage contaminating the ground water and the ground water filling basements of houses in the city of Jodhpur.

• The Water Balance of Jodhpur

– Jodhpur gets	~ 210 Mld
– Treatment Plants get	~ 50 Mld
– Rest	???!!!

$$\begin{aligned} & 160\text{Mld} \times 365 \text{ days} \times 21 \text{ years} \\ & \sim 12,30,000 \text{ Million liters} \\ & = 1,230 \text{ Million } m^3 \\ & = 1,230 \times 1,000,000 / 75,000,000 \text{ m} \\ & \sim 16 \text{ m} \end{aligned}$$

Figure 1: back of the envelop water balance of Jodhpur – 16m rise of water in 16 years

2. The Problem

Common man in the city of Jodhpur is holding two contrasting views – the water at near ground level in the city of Jodhpur is because of:

- (1) **Seepage of water from Kaylana Lake** though the fractured rocks underneath the lake bed (situated at a higher elevation than the city of Jodhpur); and
- (2) **Discarded waste water** from houses in the entire city of Jodhpur.

Based on the scientific documents (Investigations done by National Geophysical Research Institute, University of Roorkee, and the Ground Water Board), it is evident that the first reason (Seepage from underneath the rocks of the Kaylana Lake) cannot stand waters; if it were so, that should have happened for years before the arrival of canal water, because water has been collecting in the Kaylana lake for centuries now... Clearly, the only plausible reason for the growing ground water is the trapping of discarded domestic waste water; this is compounded by the fact that the strata below the city of Jodhpur is of impervious material and bowl shaped, which is not allowing water to percolate below into the pervious part of the Earth.

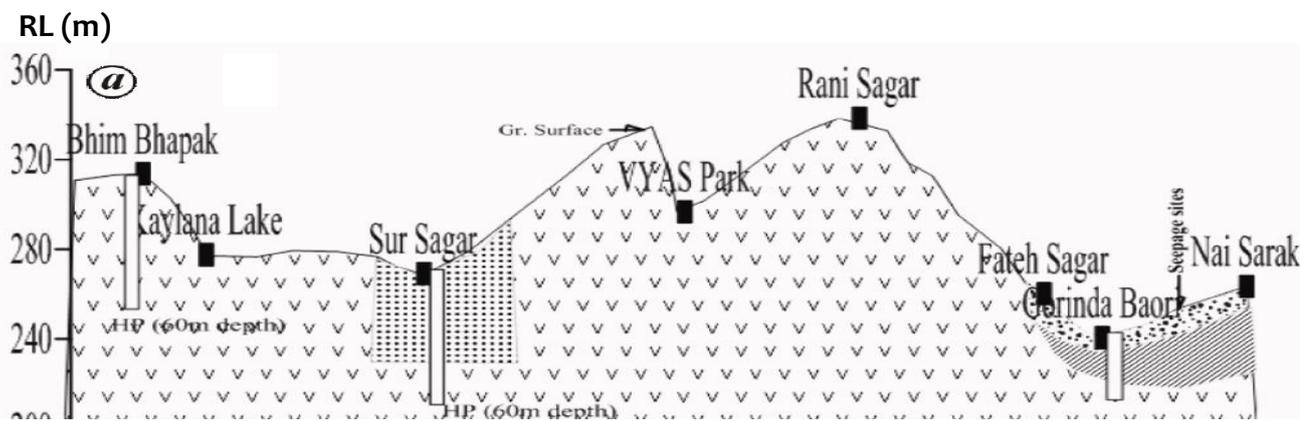


Figure 2: Cross-section of the ground in the greater Jodhpur area – the main city is located on the bowl on the right hand side

3. The Solution Tried so far

Efforts have been unsuccessful, to reduce the water logging problem in the city of Jodhpur. The civic administration has been drawing out water from upper layers of ground in the city of Jodhpur. This is not a rational solution, because the of the daily supply of water of about 210 MLD to the city of Jodhpur, about 150 MLD is being discarded into the ground each day – and the rate at which the water is being drained out through pumping is not even 10% of this volume. Currently, the installed capacity of sewage treatment plant is about 80MLD, but the actual quantity being treated is only about 30 MLD. Tens of Crores of Rupees are being lost each year... with no respite to human dignity.

4. The Way Forward...

The City of Jodhpur needs to take two hard steps, namely –

- (1) Lay **separate pipelines** for **sewage** from each household to the nearest treatment plant; the treated water can be recycled. Carry the **storm water** and **sullage** (waste water from household sinks, showers, and baths, but not waste liquid or excreta from toilets) in another set of pipelines or channels to treatment plant to detoxify the same; the treated water can be recycled. Currently, both sewage and sullage are sent to the sewage treatment plant; it is wasteful to mix sullage (which requires lower level of treatment) with sewage (which requires much higher level of treatment).

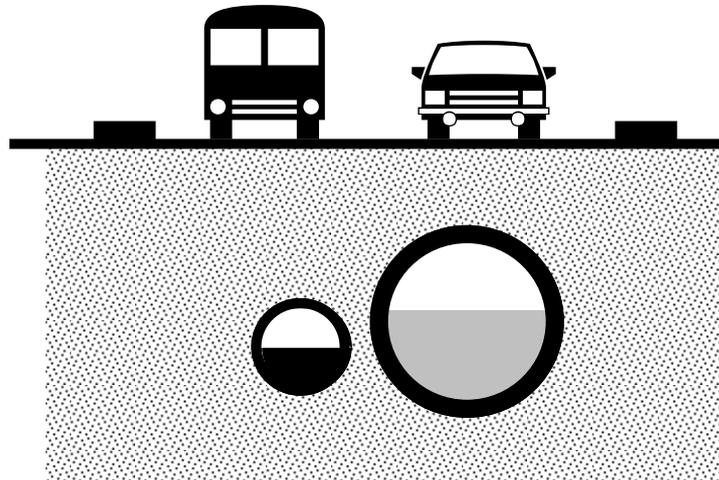


Figure 3: Separating at the household level the Sewage and Sullage collected from the city of Jodhpur, and carrying them in different pipelines to the respective treatment plants

- (2) Make at least 3-4 **large diameter underground tunnels** from the center of the city to points along the Jojri River, which is located on the outskirts of the city. The Jojri River is about 20-30m lower in elevation compared to the center of the city of Jodhpur, where the water is trapped in the underlying impervious bowl shaped strata. This facilitates the gravity flow of water collected in the tunnel, and does not need any electricity to drive any pump to draw water from the ground or drain the water through the tunnel. The tunnels do not require any additional land, as they can be laid below the existing National and State Highway Roads passing through the city of Jodhpur. Water can be brought to the 3-4 tunnel segments by smaller drainage channels or pipes, if the natural percolation is less.

The typical cross-section of the tunnel can be up to 10-14m diameter – these tunnels are much like the tunnels constructed by Delhi Metro for passing the Metro Trains below ground. Internationally, this is accepted and practiced norm for handling city level storm water and sullage (e.g., New York). The water can be collected in the tunnels can be treated before being passed into the Jojri River, if not recycled for irrigation or for other purposes. The cost of making the tunnels can be recovered in about 10-12 years time, from the money saved by stopping the current pumping of water out of the ground. Also, the solution with the tunnel will eliminate the water clogging that recurs every time there is rain in the city of Jodhpur for an extended period (of up to 2 hours).

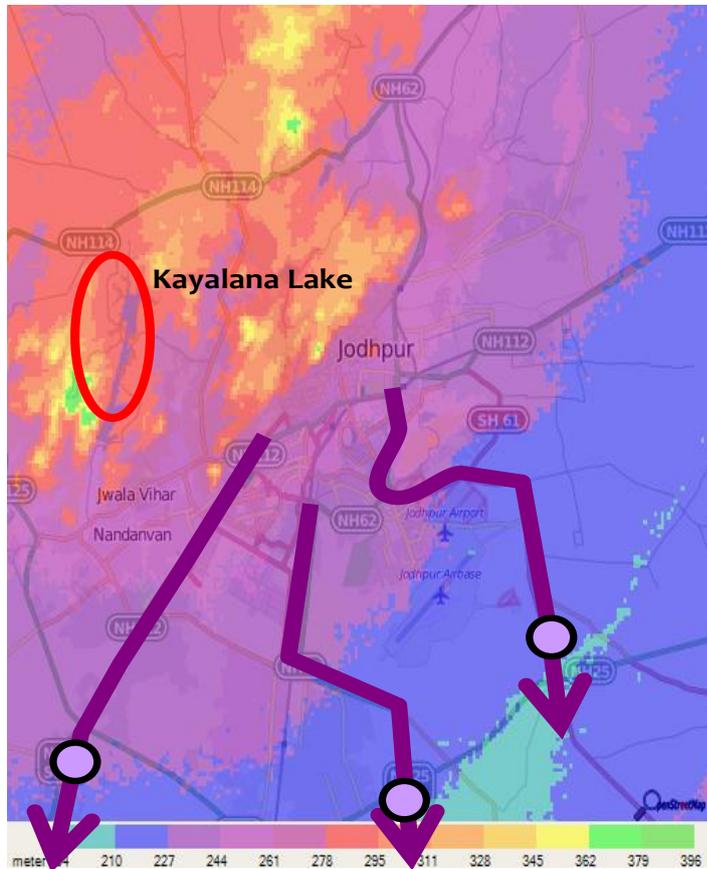


Figure 4: Proposal to construct Large diameter underground tunnel to carry the ground water by gravity flow – the tunnels can be laid under the exiting road system to avoid additional land requirement

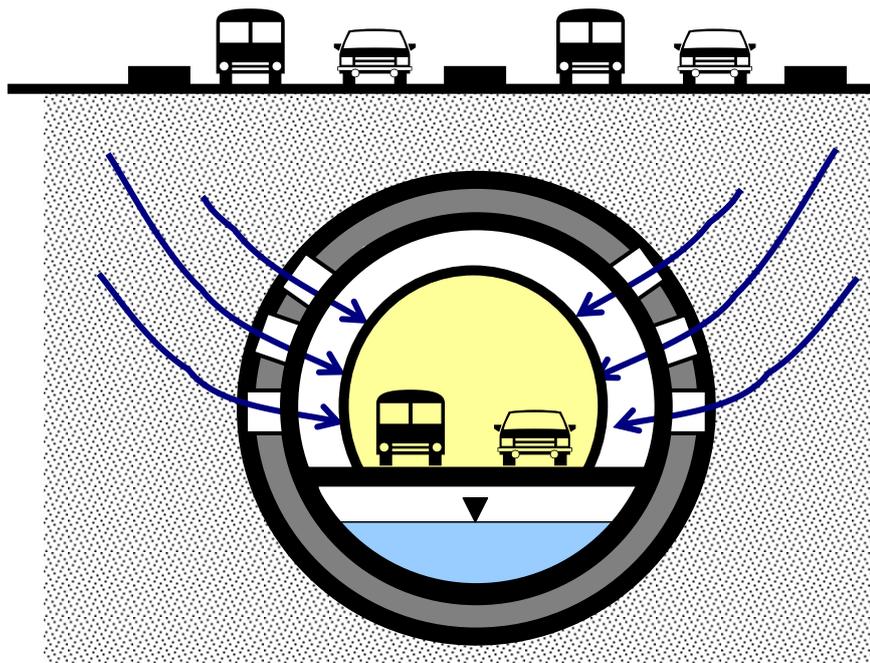


Figure 5: Large diameter underground tunnels carry the ground water by gravity flow – the tunnel can be used for laying other services also, like electricity and telephone lines

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