

Mainstreaming Groundwater in Urban Planning



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Groundwater: source & sink

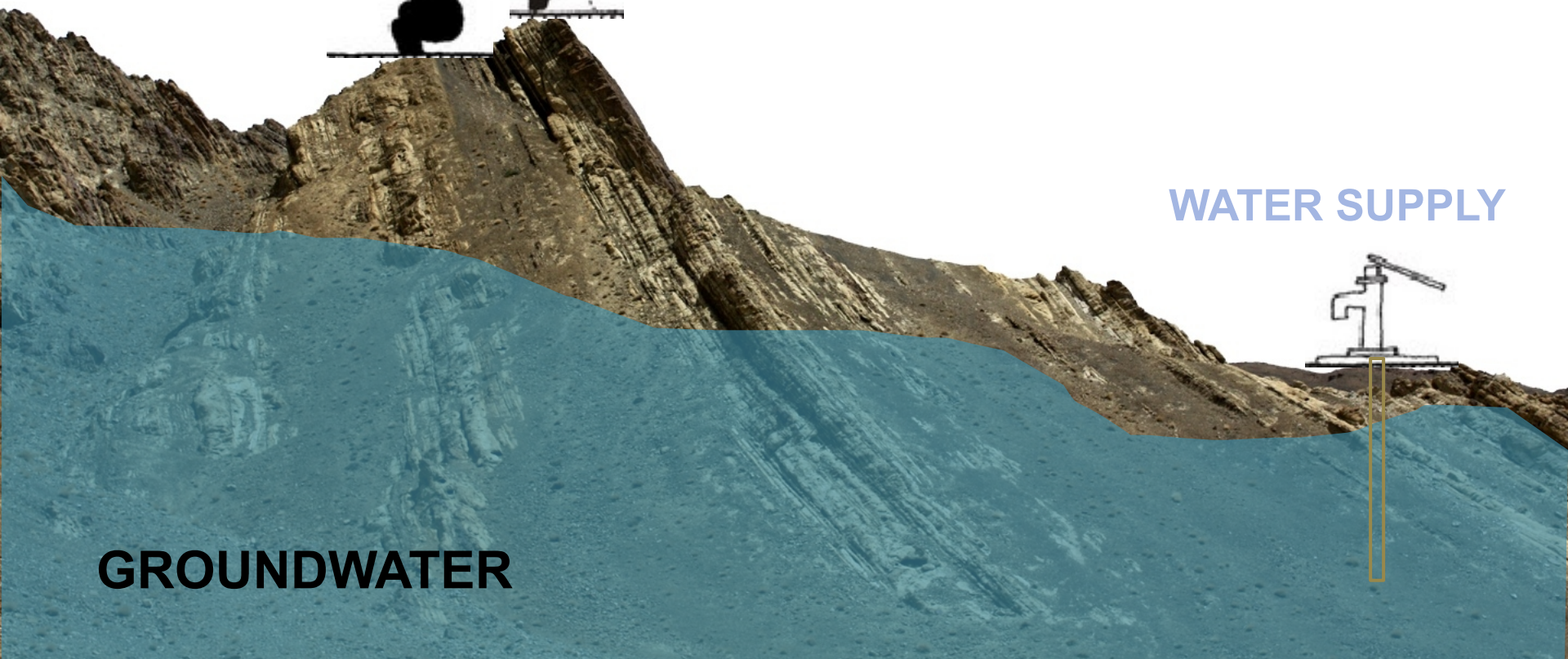
SANITATION



WATER SUPPLY



GROUNDWATER



The larger picture

Global estimate: more than 1.5 billion urban dwellers rely on groundwater, currently

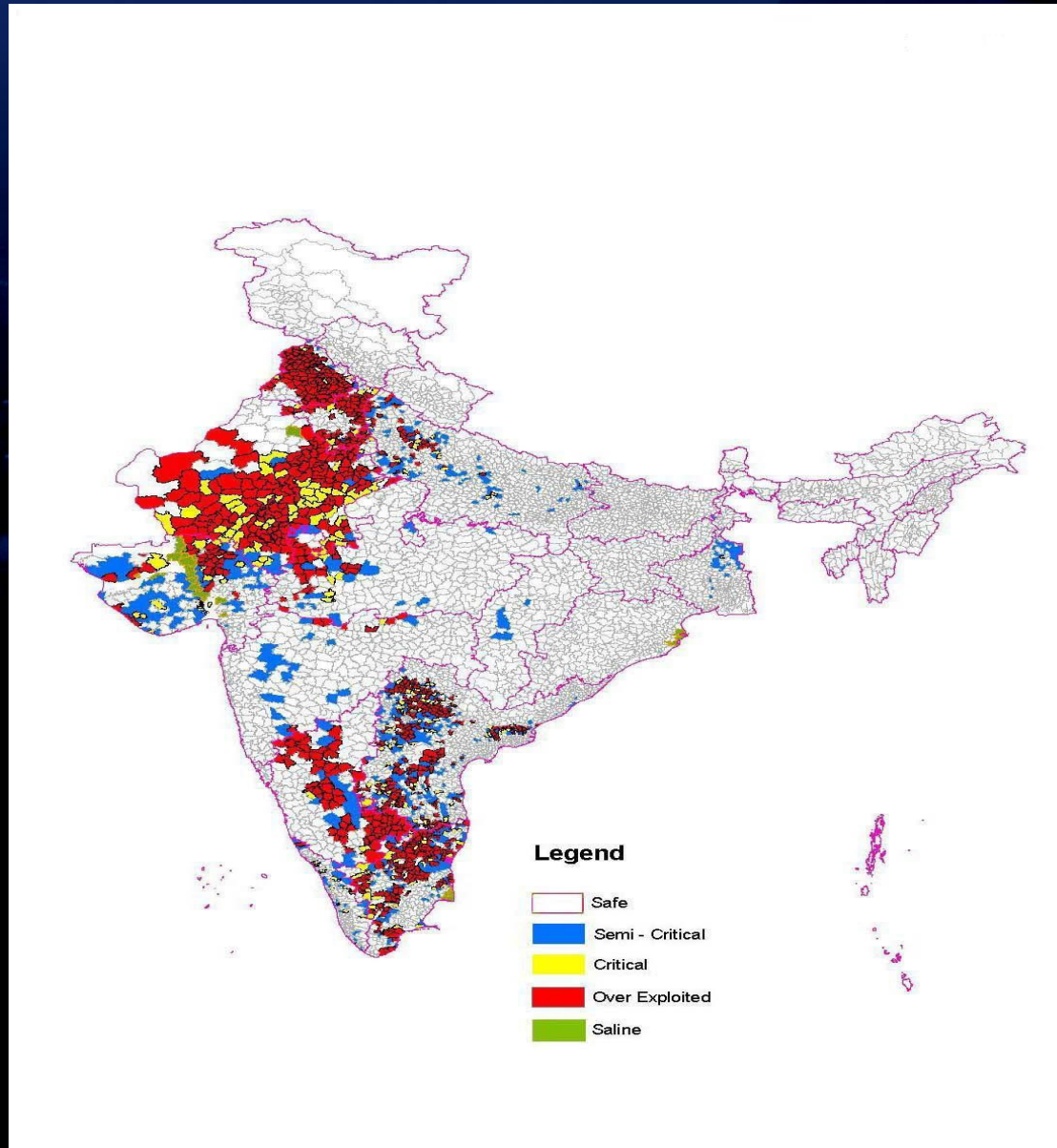
Dependence on groundwater, especially in “developing cities”:

- Population growth

- Rapid urbanisation – city sprawl

- Increased per-capita use

Hues of groundwater exploitation

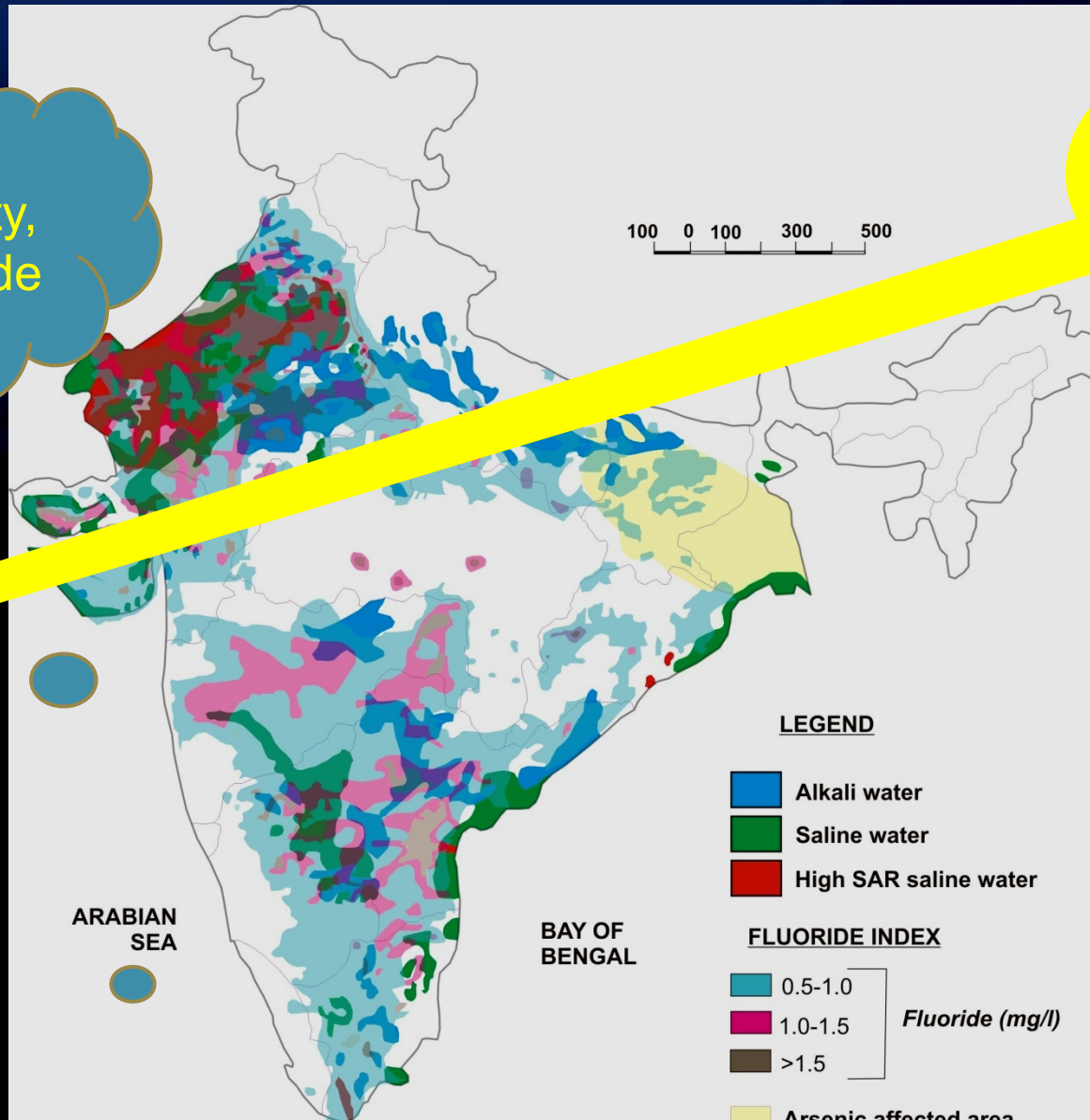


Groundwater quality

Salinity,
Fluoride

Iron, Arsenic,
Fluoride

Salinity,
Fluoride



Modified after:
Krishnan, 2009

Water sector, groundwater and urban WSS

OVERALL WATER SECTOR

Changing approaches to WR Planning in India - significant inputs from a wider net of organisations on various aspects in the water sector

Consideration to wide-ranging scales in attempting reform – major irrigation projects to Rural WSS (habitation level)

URBAN WATER & SANITATION

Importance of water – sanitation, sewage, wastewater links

Challenges with respect to sewerage

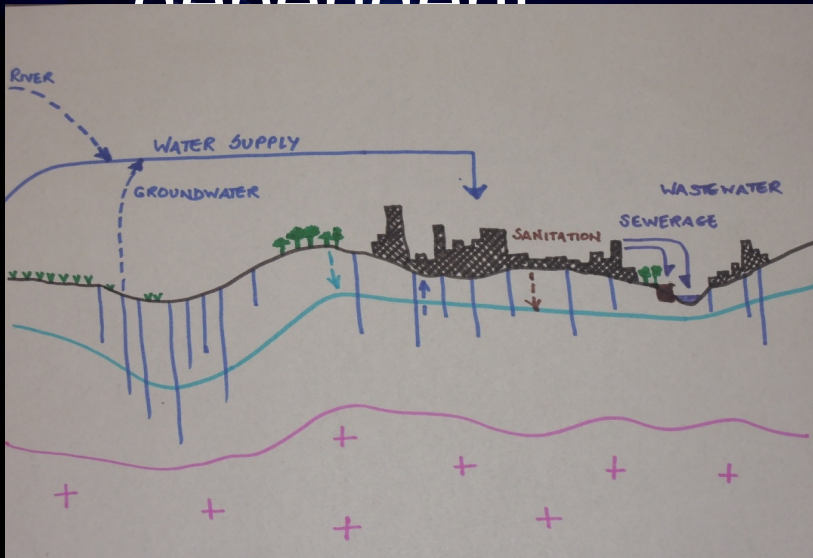
Dichotomy of equitability wrt to water and waste: *Water for all is more easily accepted but we are unable to deal with the waste-of-all*

Groundwater in the urban space

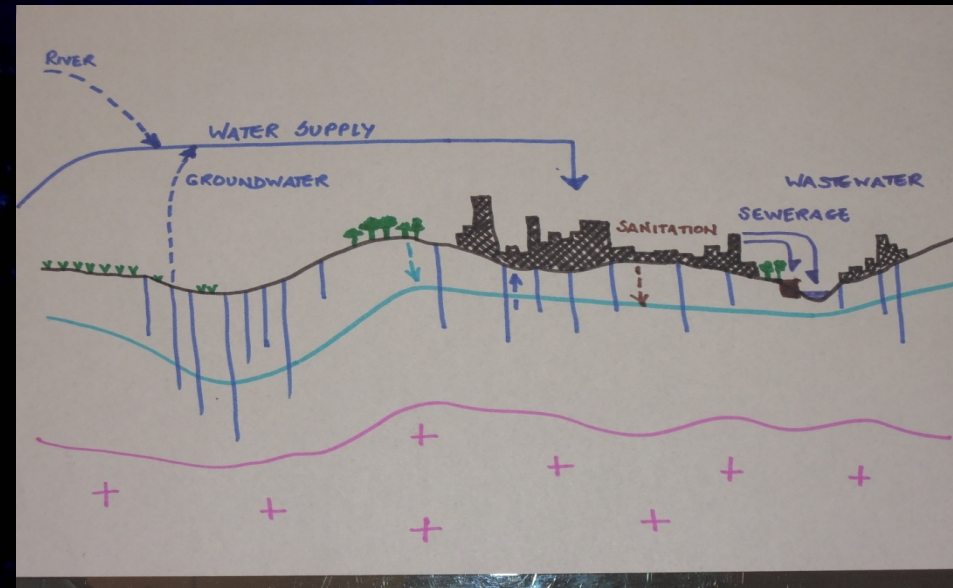


Urban groundwater – 2 scenarios

Fully groundwater dependent



Groundwater supplements river



Groundwater use already *mainstreamed* in operation –
but seldom part of Urban Water Planning

Urban groundwater: common issues

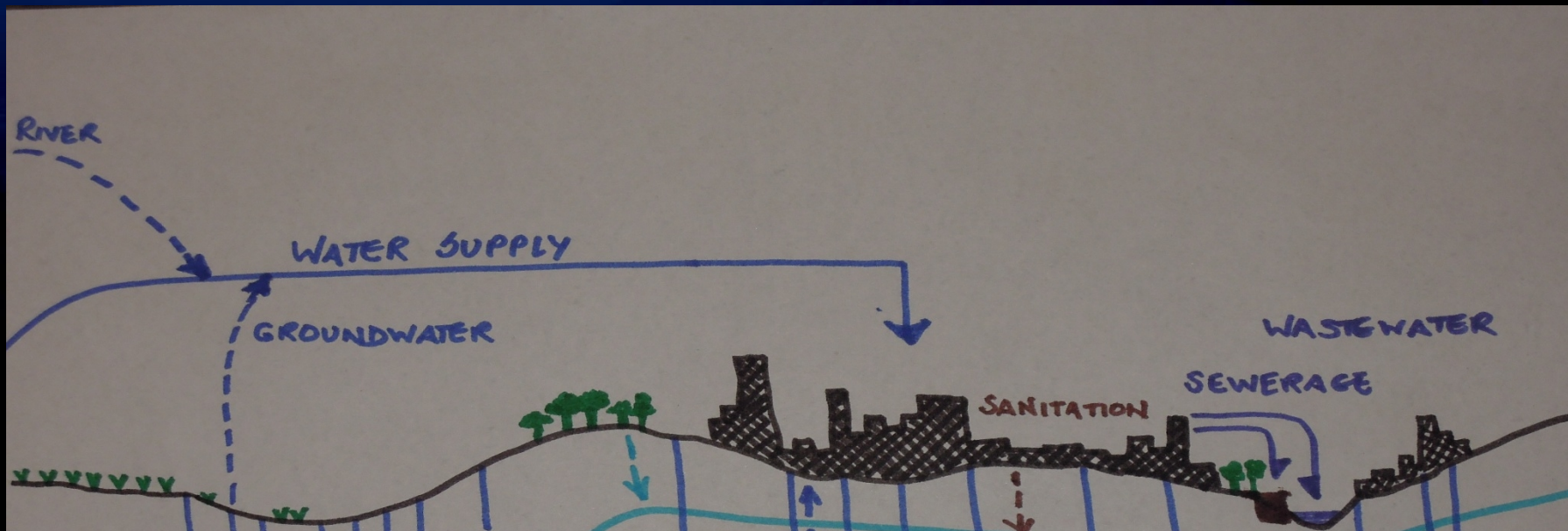
Foster et al, 2010: GW-MATE

Modification of groundwater cycle on account of urbanisation

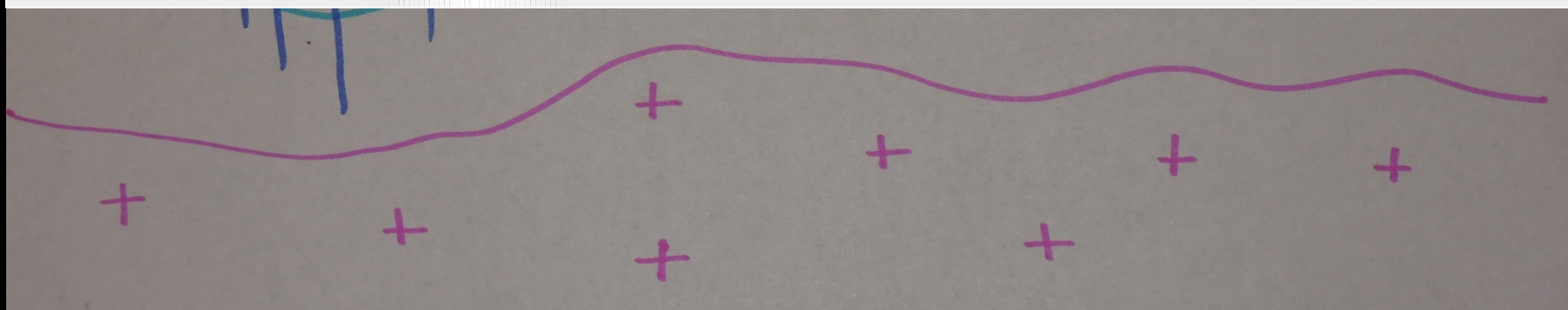
Many problems around groundwater are *predictable*, few are *predicted*

Conceptual hydrogeological model not constant – needs continuous modification

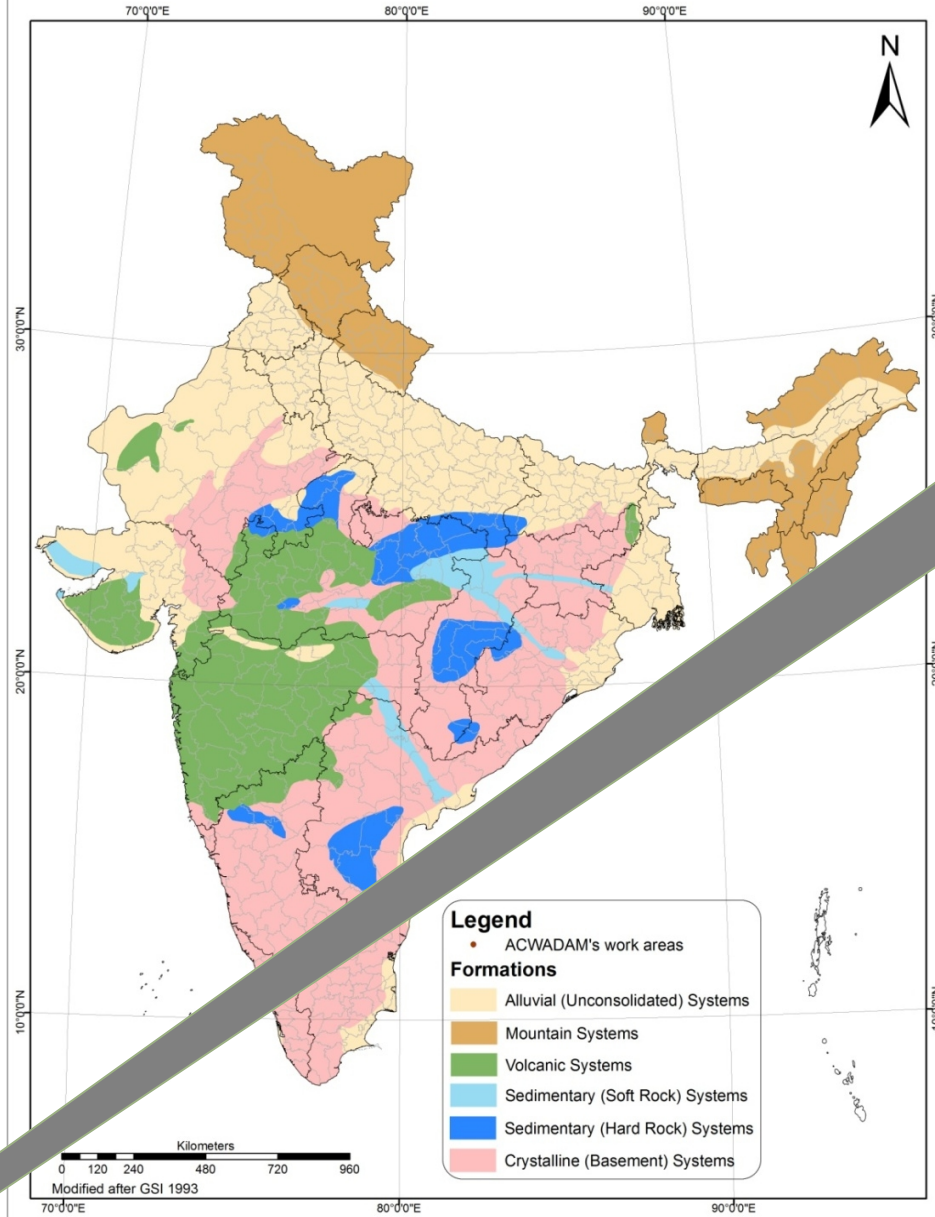
Aquifer setting – the missing dimension



Is this constant or uniform....?



Overlay of generalised hydrogeological settings on administrative boundaries (Districts and states)

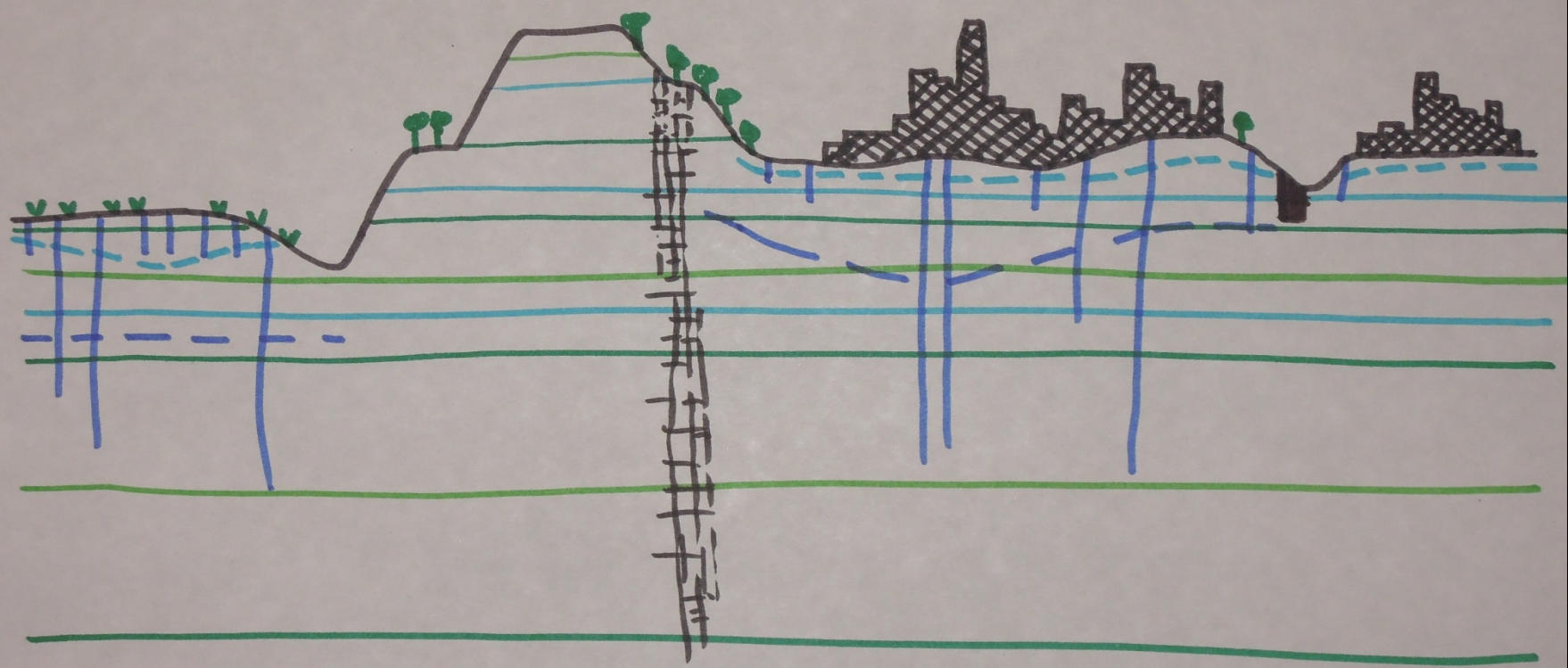


Diversity

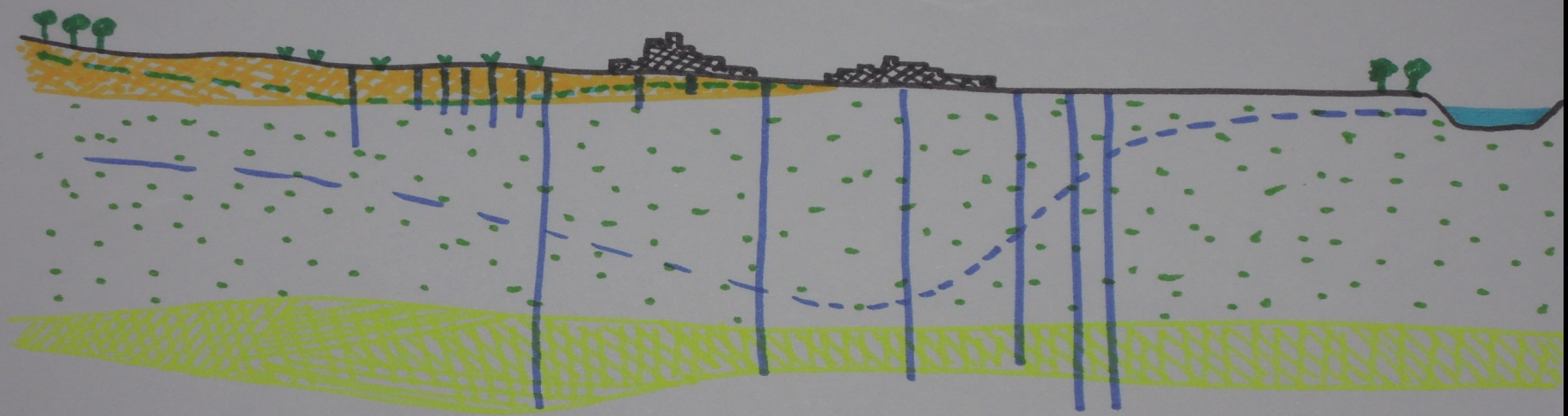
Crystalline / Basement Rocks



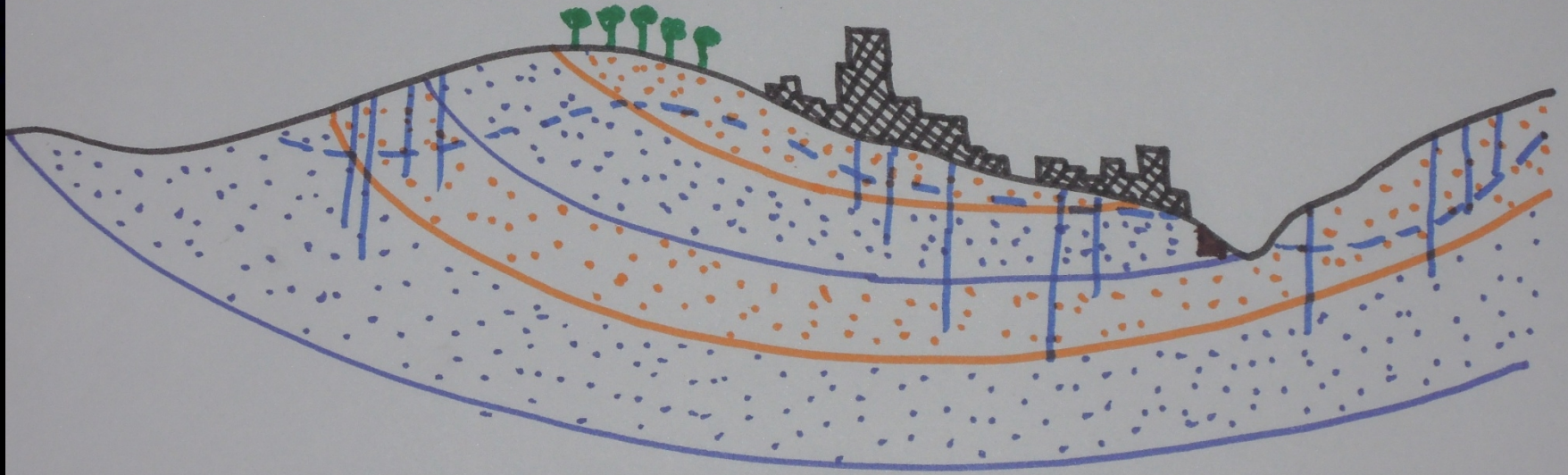
Volcanic rocks



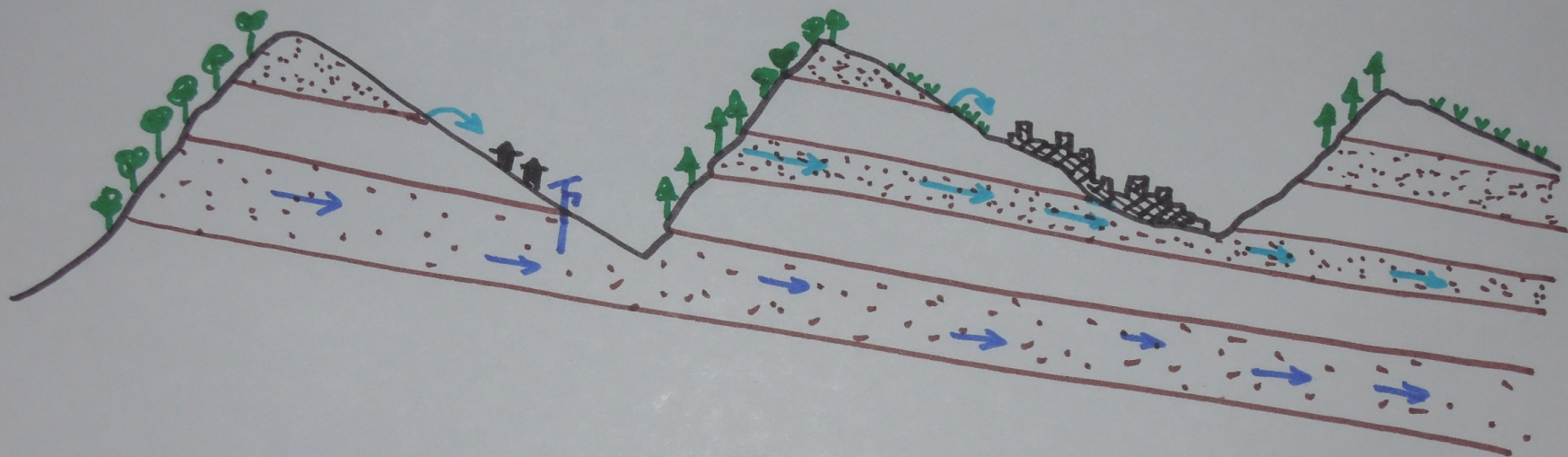
Alluvium



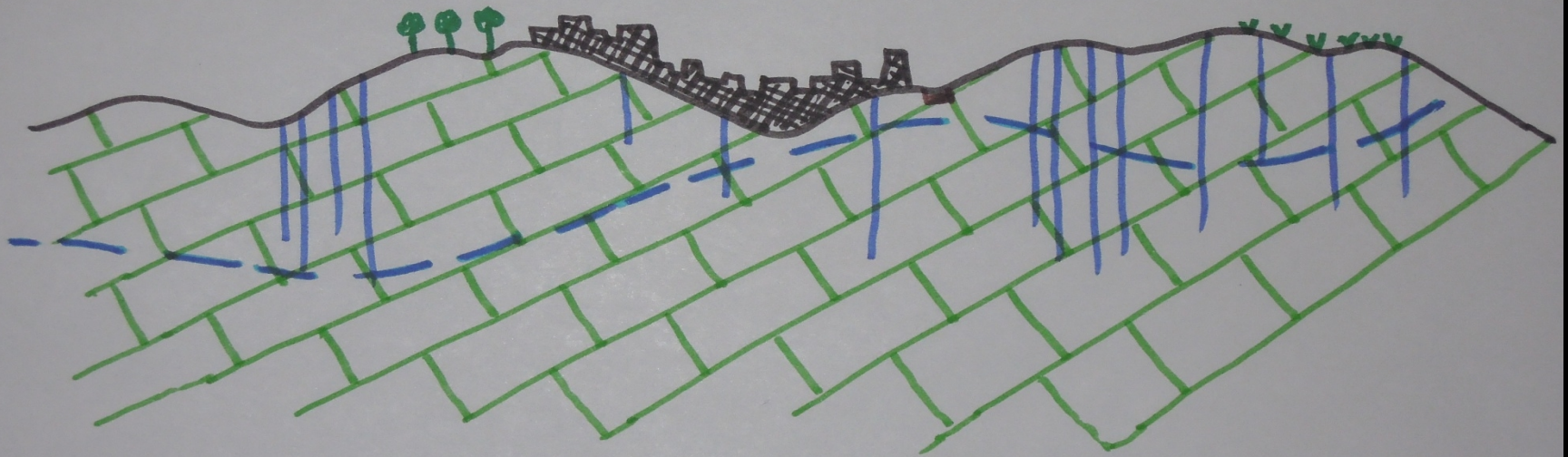
Consolidated sedimentary rocks



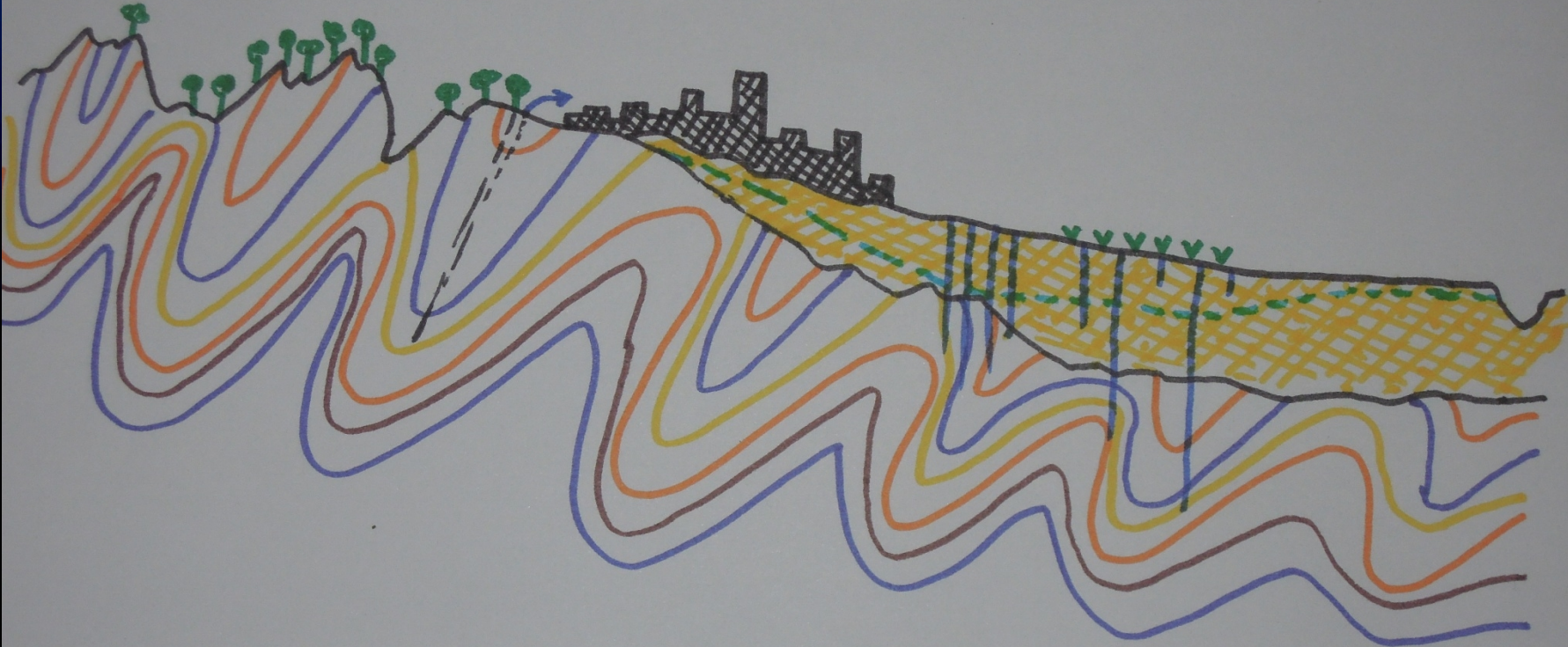
Himalaya



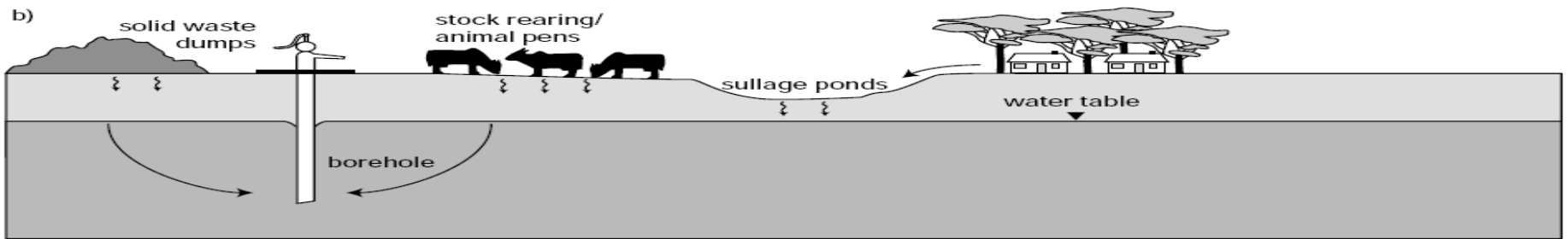
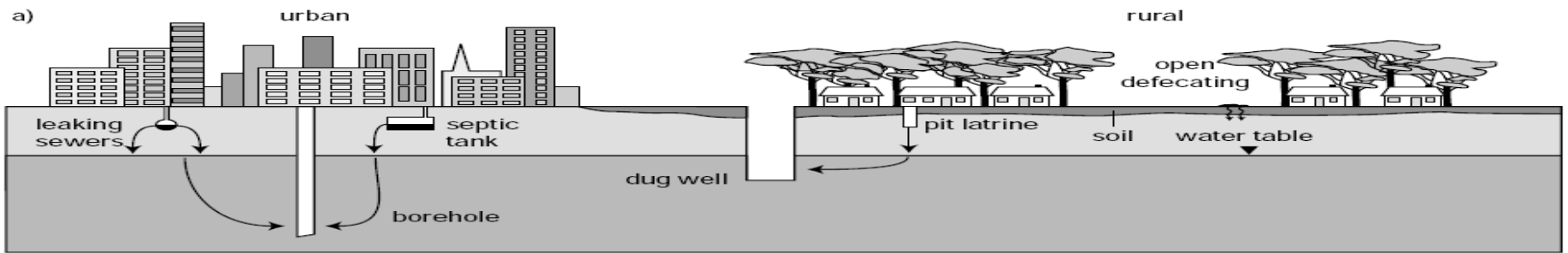
Carbonate rocks / limestones



Multiple / compounded



From generics...



...to specifics (wrt sanitation)

Hydrogeological environment		natural travel time to saturated zone	attenuation potential	pollution vulnerability
Thick sediments associated with rivers and coastal regions	shallow layers	weeks-months	low-high	high
	deep layers	years-decades	high	low
Mountain valley sediments	shallow layers	months-years	low-high	low-high
	deep layers	years-decades	low-high	low-high
Minor sediments associated with rivers		days-weeks	low-high	extreme
Windblown deposits	shallow layers	weeks-months	low-high	high
	deep layers	years-decades	high	low
Consolidated sedimentary aquifers	sandstones	months-years	low-high	low-high
	karstic limestones	days-weeks	low	extreme
Weathered basement	thick weathered layer (>20 m)	weeks-months	high	low
	thin weathered layer (<20 m)	days-weeks	low-high	high

Mainstreaming

- Comprehensive understanding of groundwater resources (aquifers) required

Information on sources, usage, impacts (especially recharge and quality)

Logic of including groundwater in the *formal civic water supply system*

Examine whether such a move will take the pressure off individualistic access to groundwater

Link regulation and licensing to assured water supply and equitability

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