

# Sustainable ET Landfill Caps – A Closer Look at Hydraulic Equivalency

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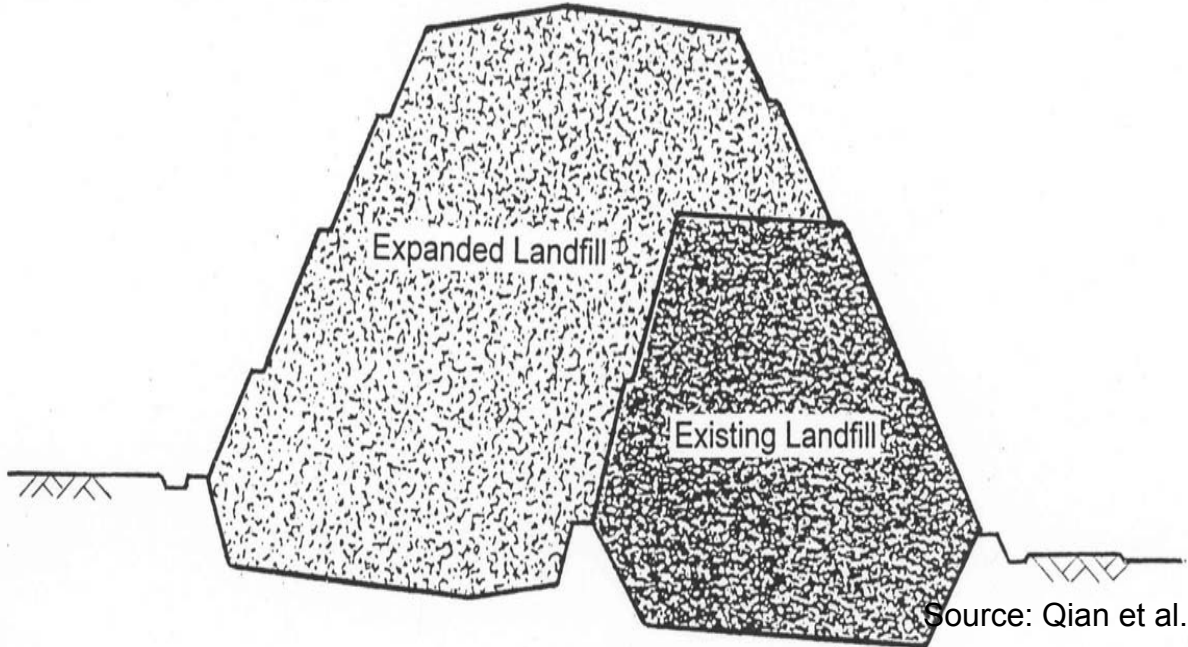
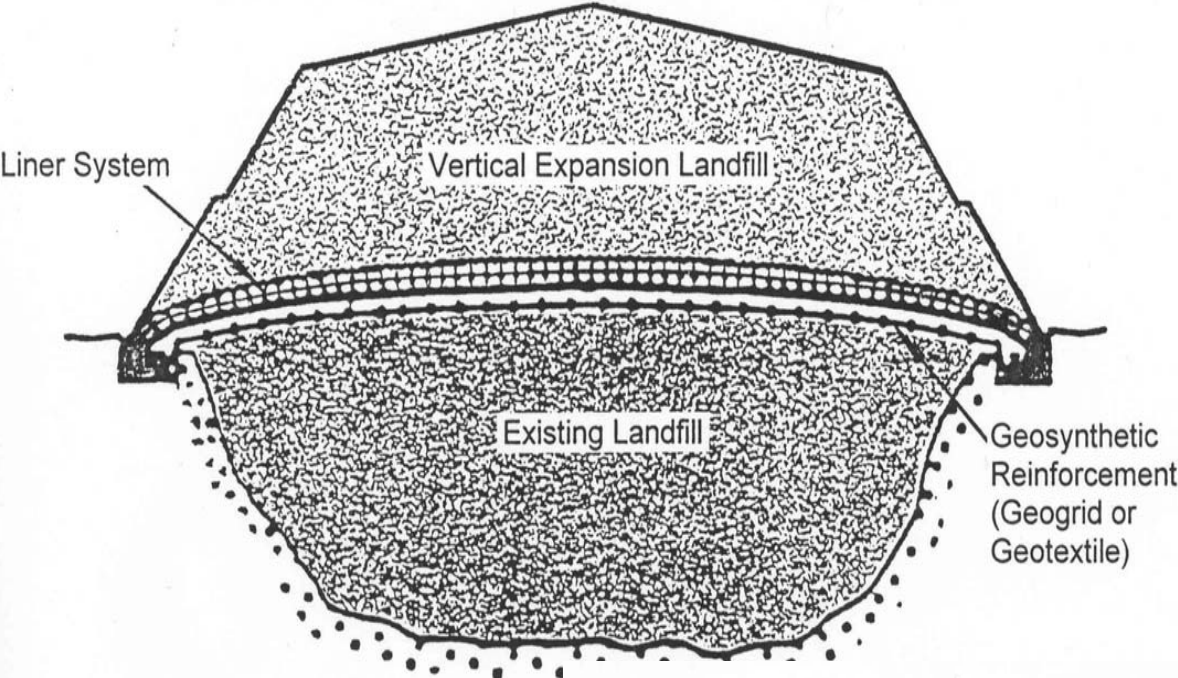
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**U N I V E R S I T Y**

# Megafills

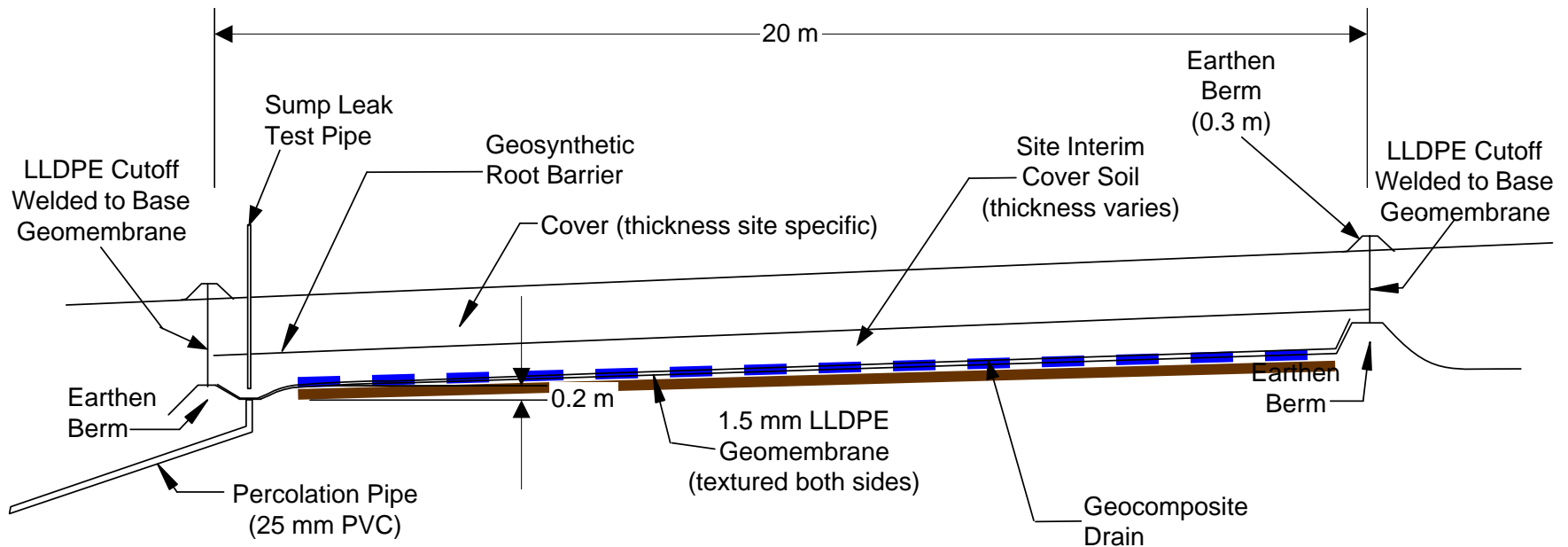


Source: Qian et al.



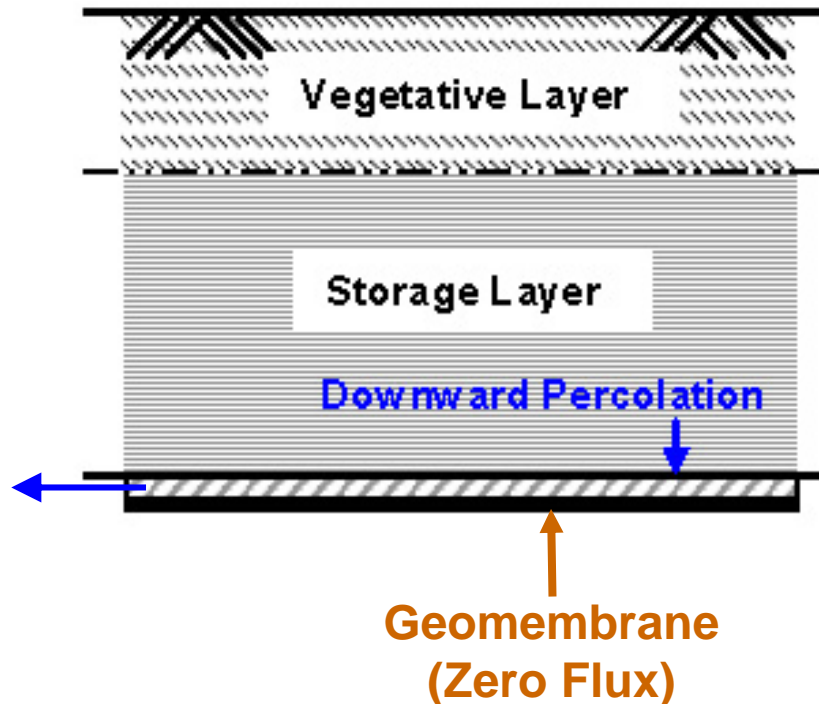
Source: Qian et al.

# Typical Lysimeter (ACAP)

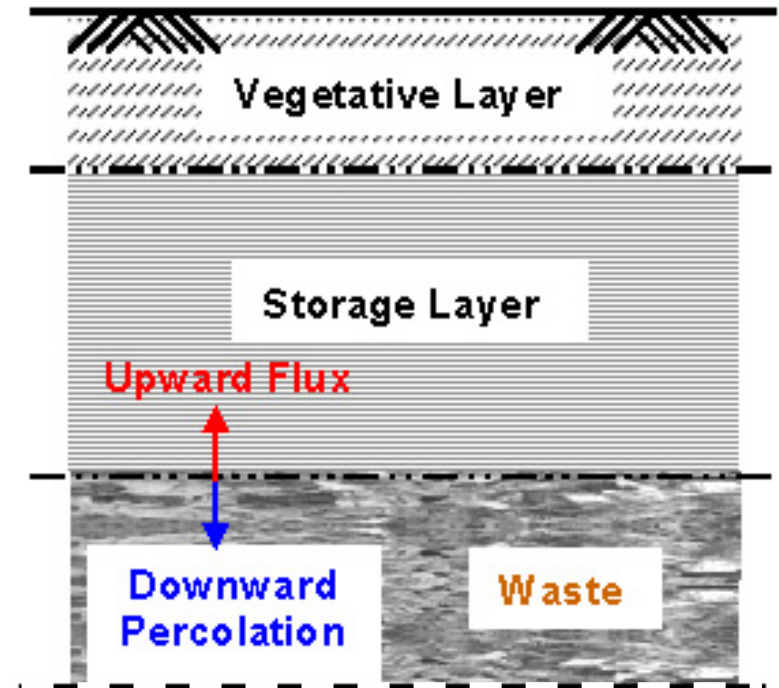


# Lysimeters vs. Actual Final Caps – Hydraulic Differences

## Lysimeter (a)

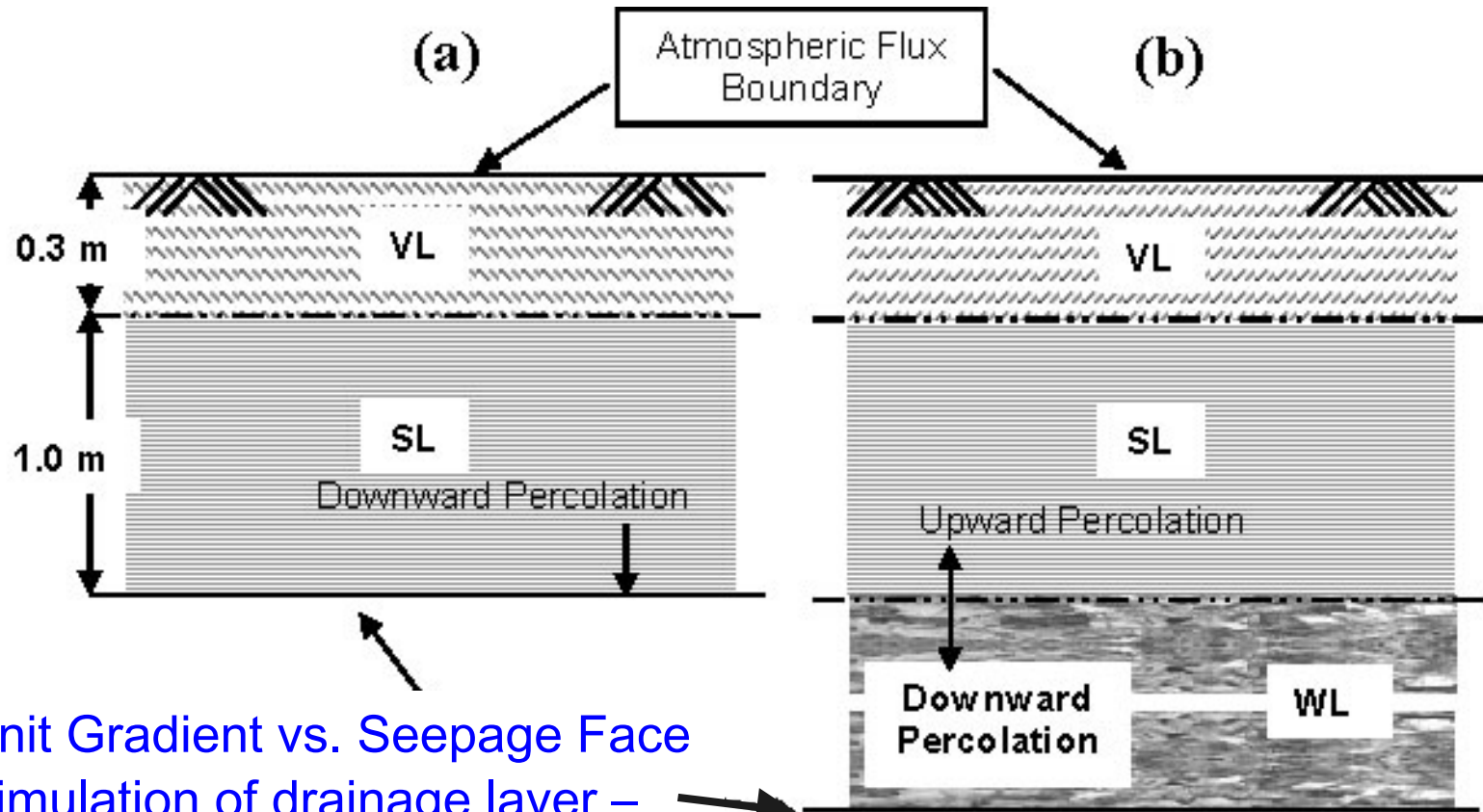


## Actual Cap (b)



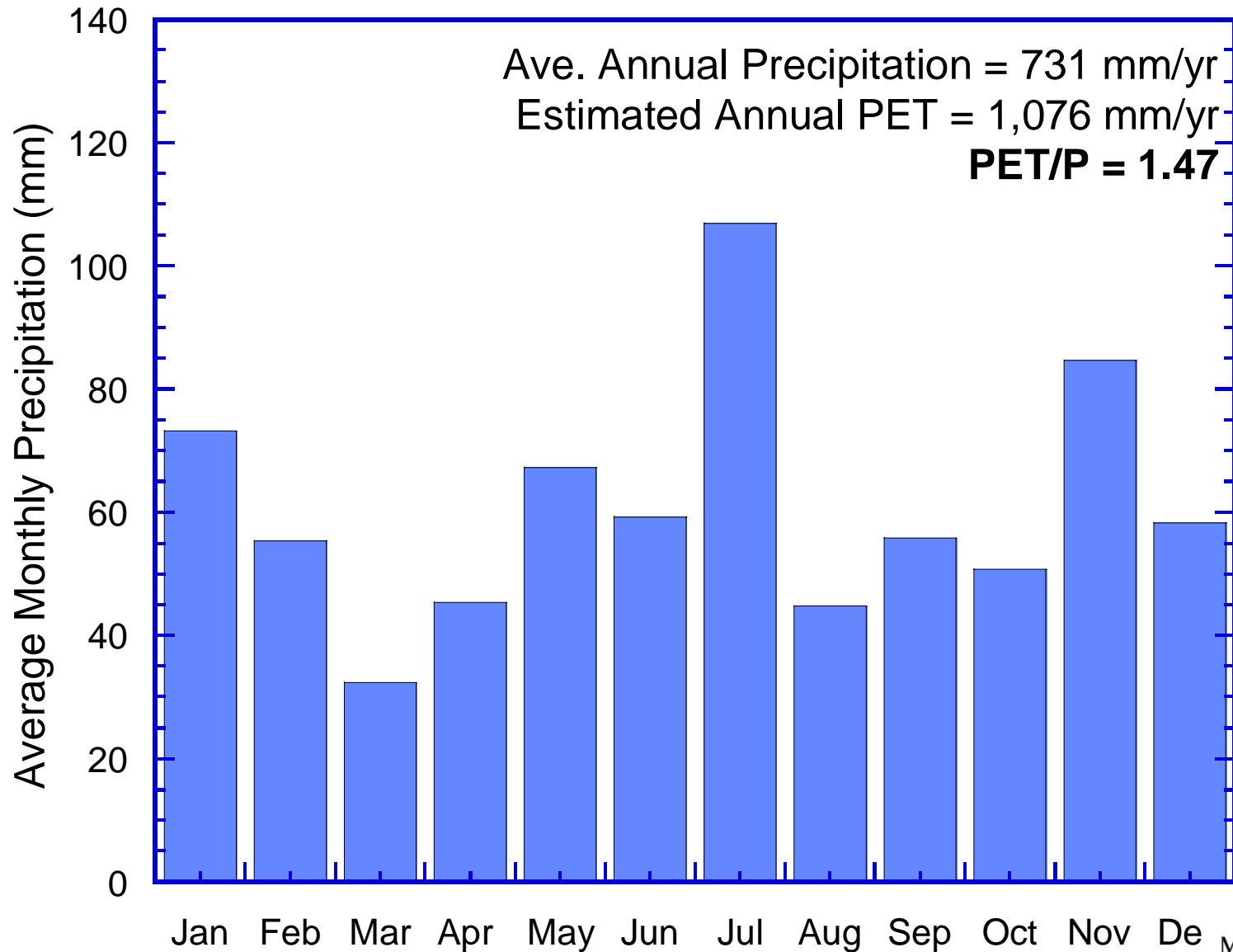
- Equivalency Demonstration Required
- Percolation needs to be  $<$  few mm/year for an ET Cap to receive permit

# Numerical Simulation using Vadose/W



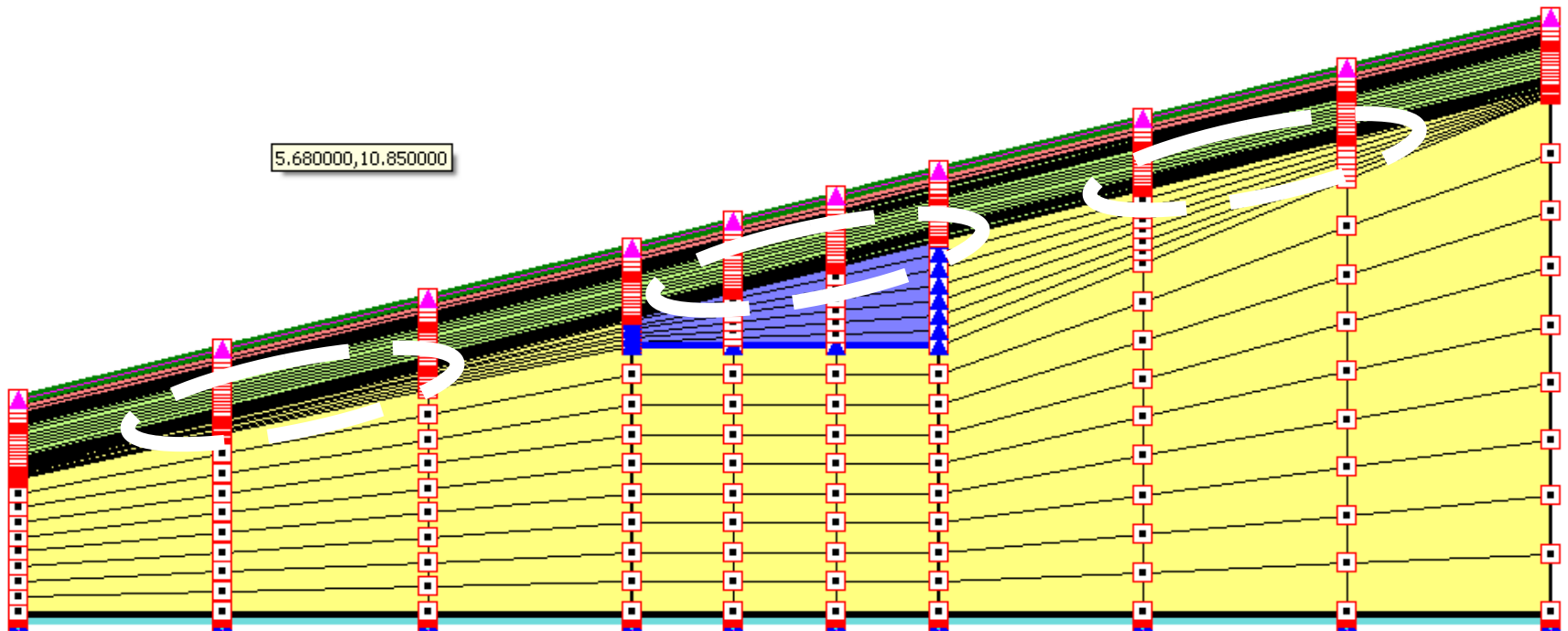
- Unit Gradient vs. Seepage Face
- Simulation of drainage layer – Capillary Break?

# Precipitation Data - Detroit



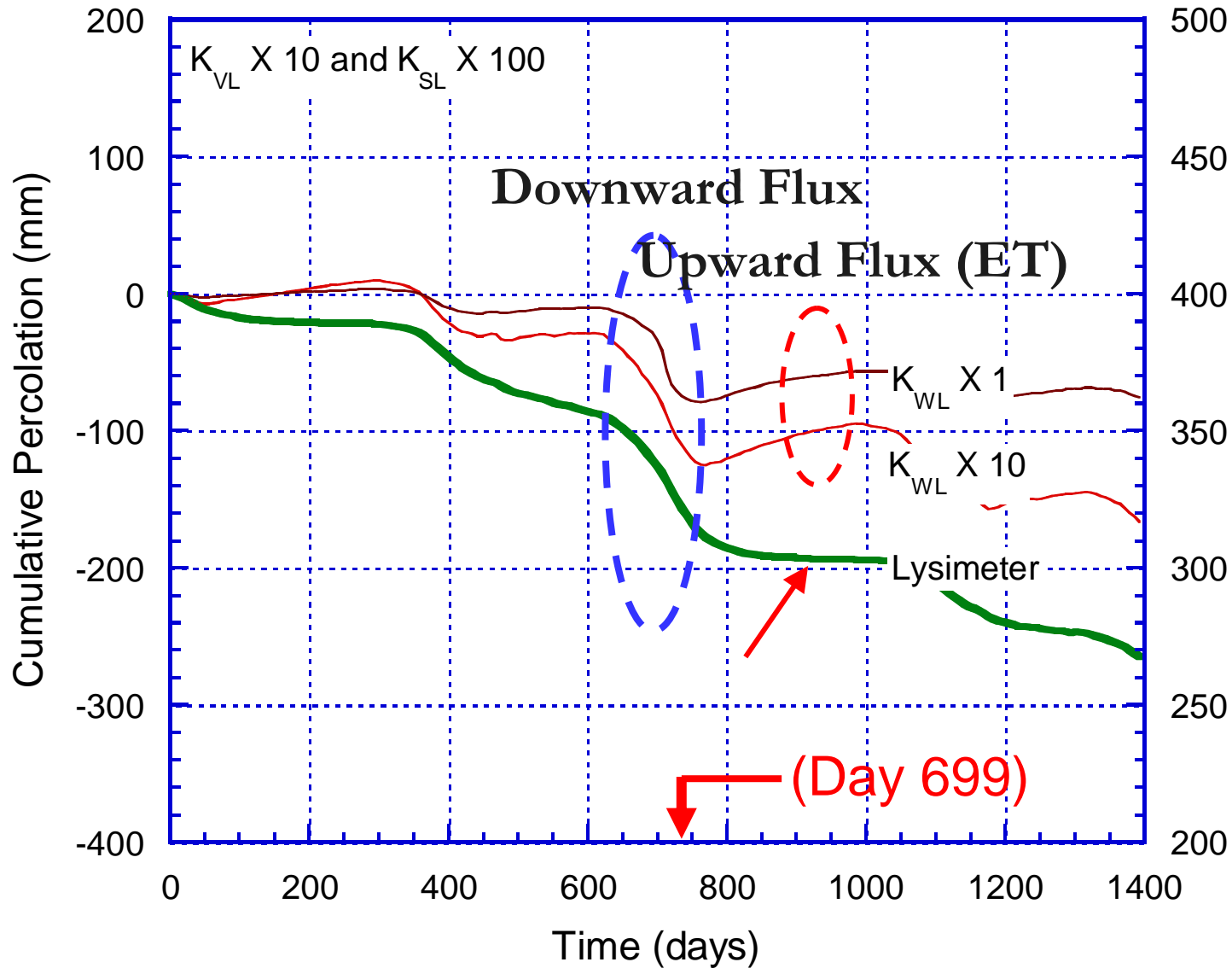


# Finite-Element Mesh in Vadose/W: 2-D



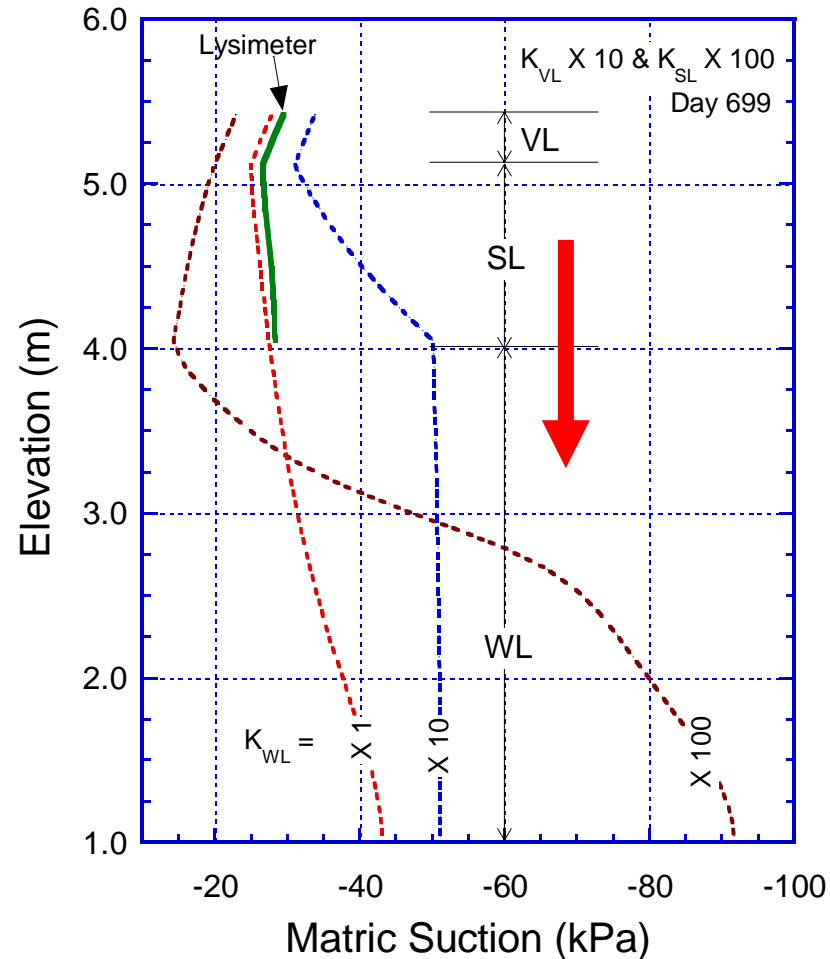
- Only Capillary flow considered
- Flow through cracks needs to be simulated

# Simulated Percolation: Upward vs. Downward

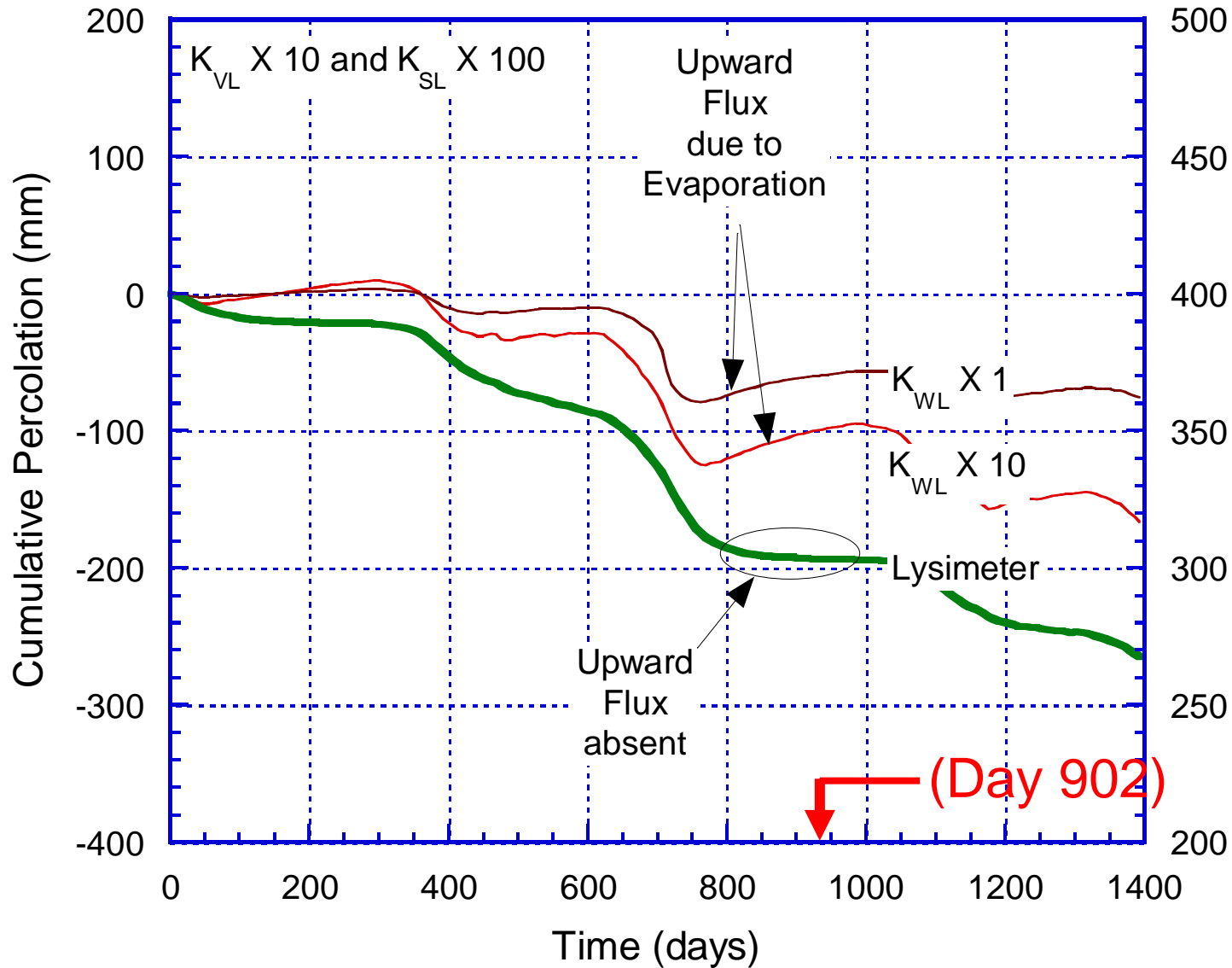


Source: Khire and Mijares (2008)

# Simulated $\psi$ Profiles: Day 699 (Downward Percolation)

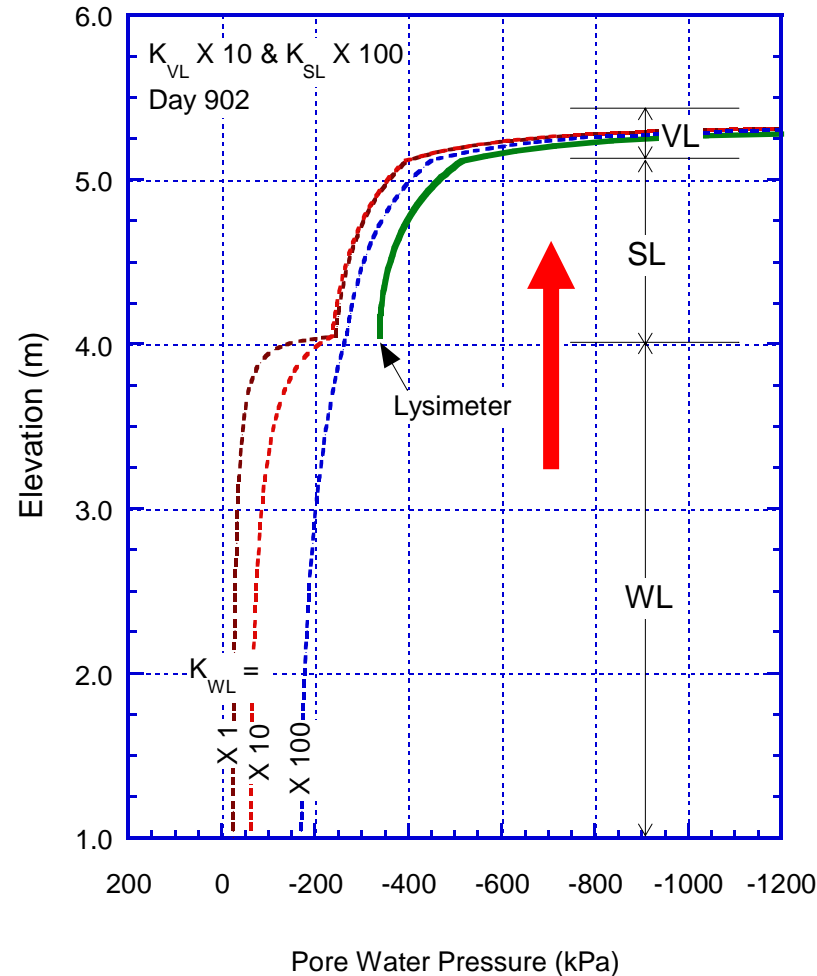


# Simulated Percolation: Upward vs. Downward

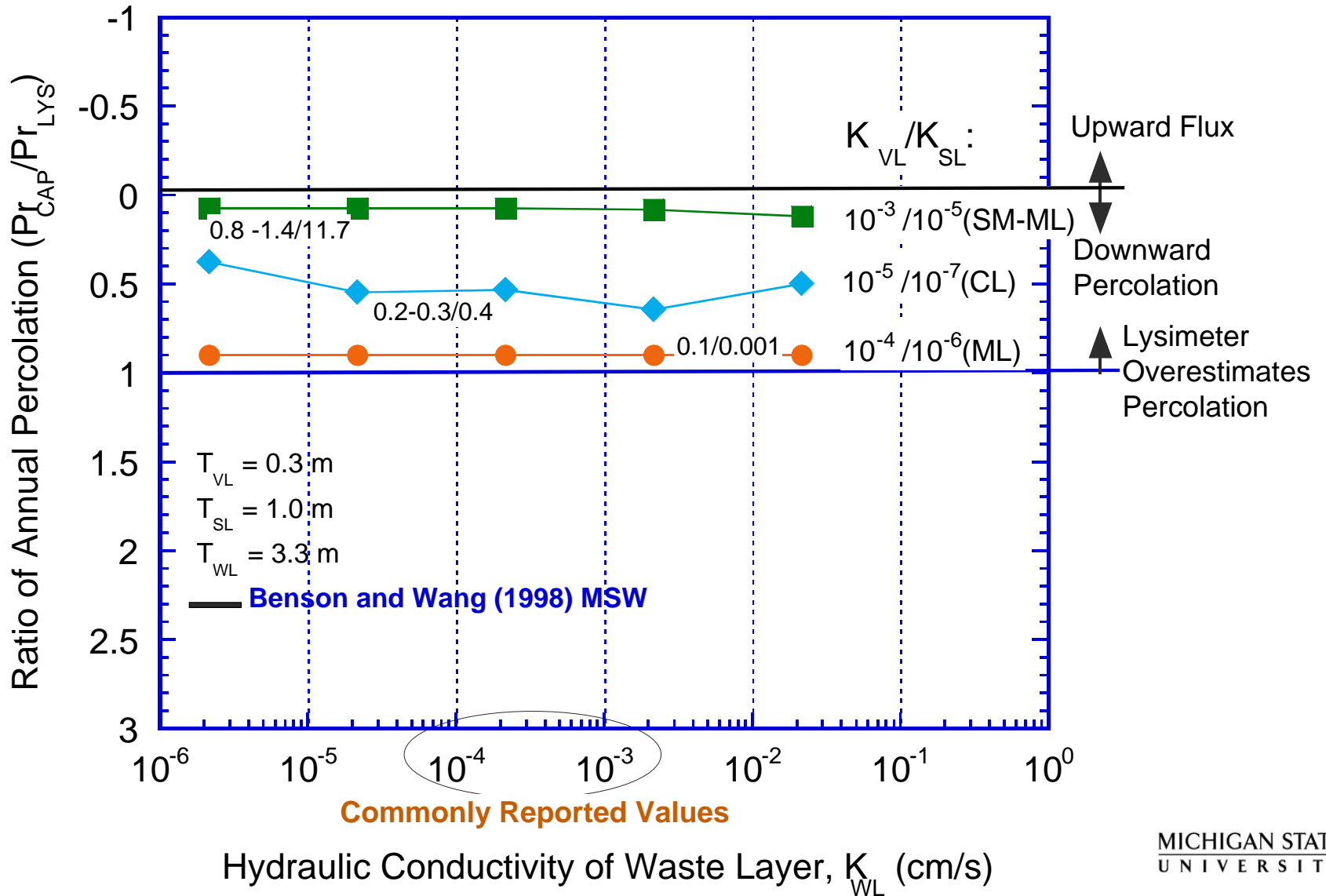


Source: Khire and Mijares (2008)

# Simulated $\psi$ Profiles: Day 902 (Upward Flux)

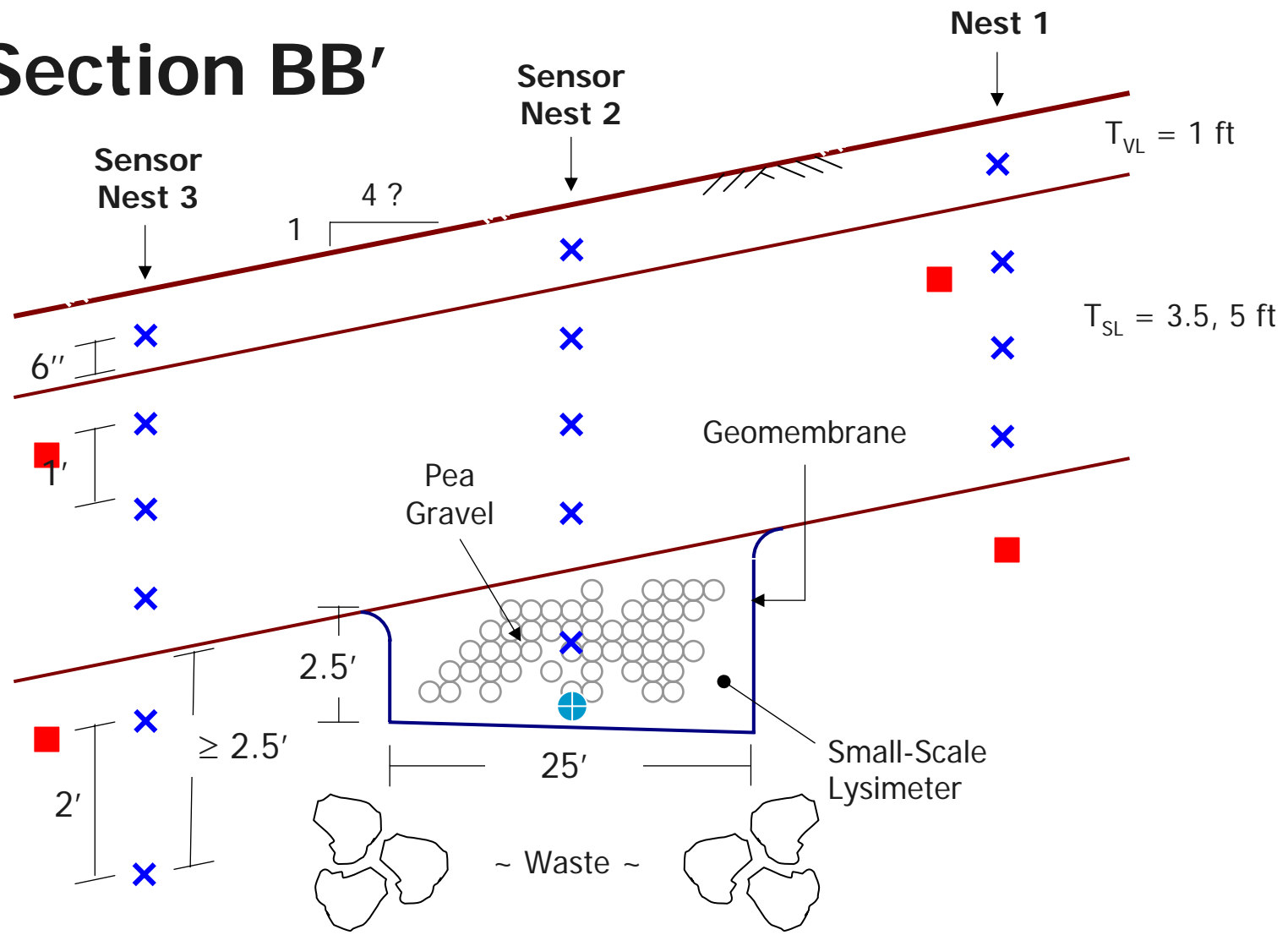


# Simulated Relative Percolation (Capillary Flow Only)



# Field-Scale Testing

# Cross Section BB'



× Water Content and Water Potential Sensors

## Legend:

■ Gas Pressure Sensor

⊕ Liquid Level Sensor

Not to Scale



# Lysimeters



# Lysimeters

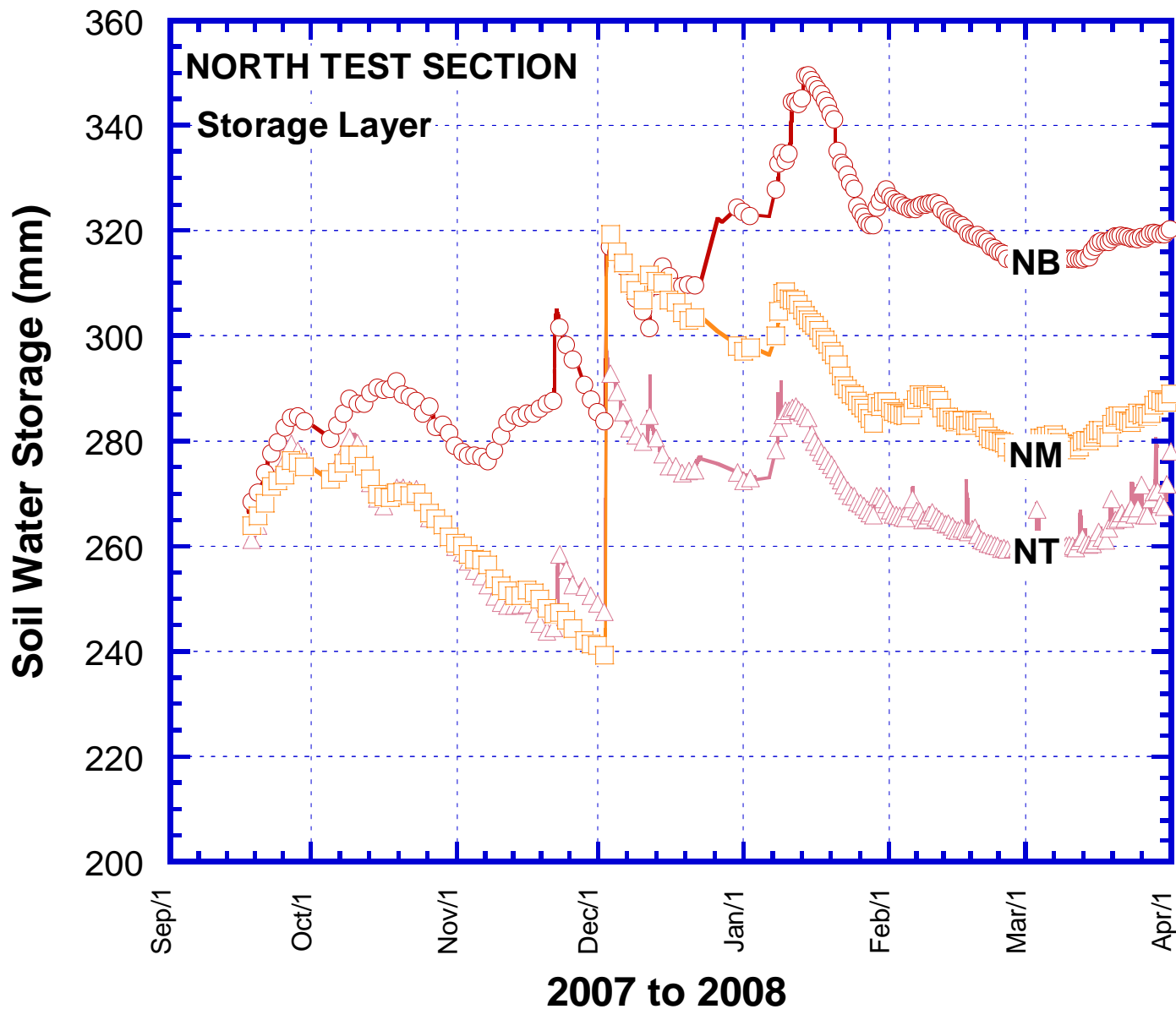




# Completed Test Sections



# Field Data (Preliminary)



# Summary

- Percolation through lysimeters may not be representative of the percolation through an actual cap – Waste Layer Present
- Gas pressures in the landfill will also impact percolation for actual caps
- Saturated and unsaturated properties of waste and flow through cracks will influence actual percolation

# Acknowledgements

- Waste Management, Inc.
- Environmental Research & Education Foundation



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