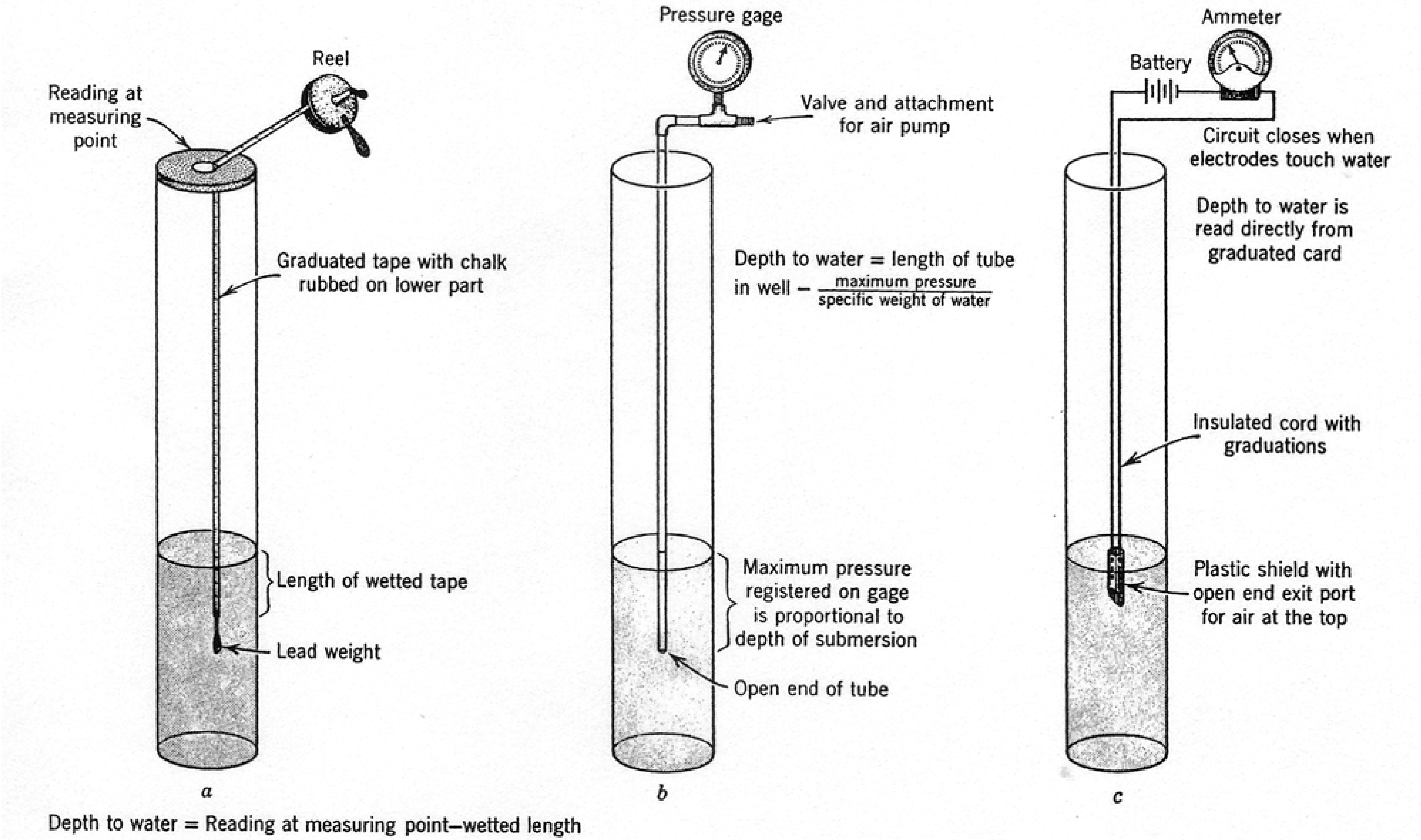
Piezometri e pozzi di monitoraggio

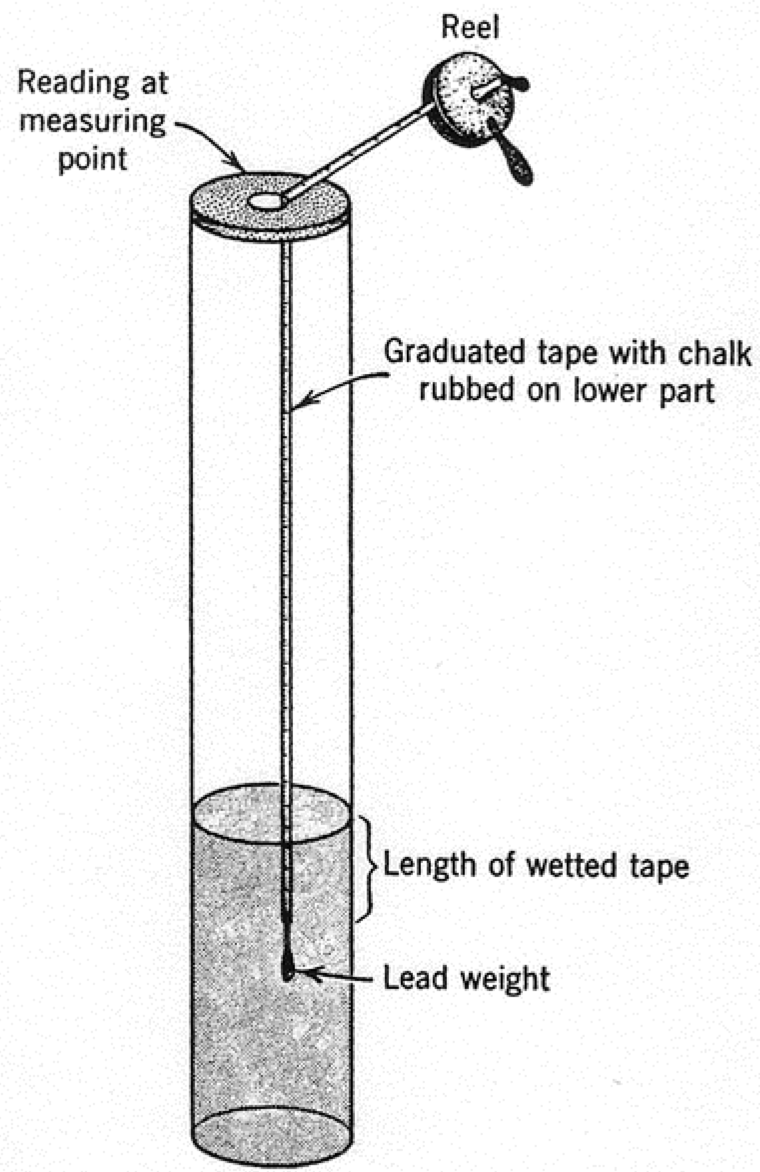
(*misurazione e caratterizzazione del flusso sotterraneo*)

Strumenti per la misura di livello in pozzo



(*From: Fig. 2.28; Davis & DeWiest, 1966*)

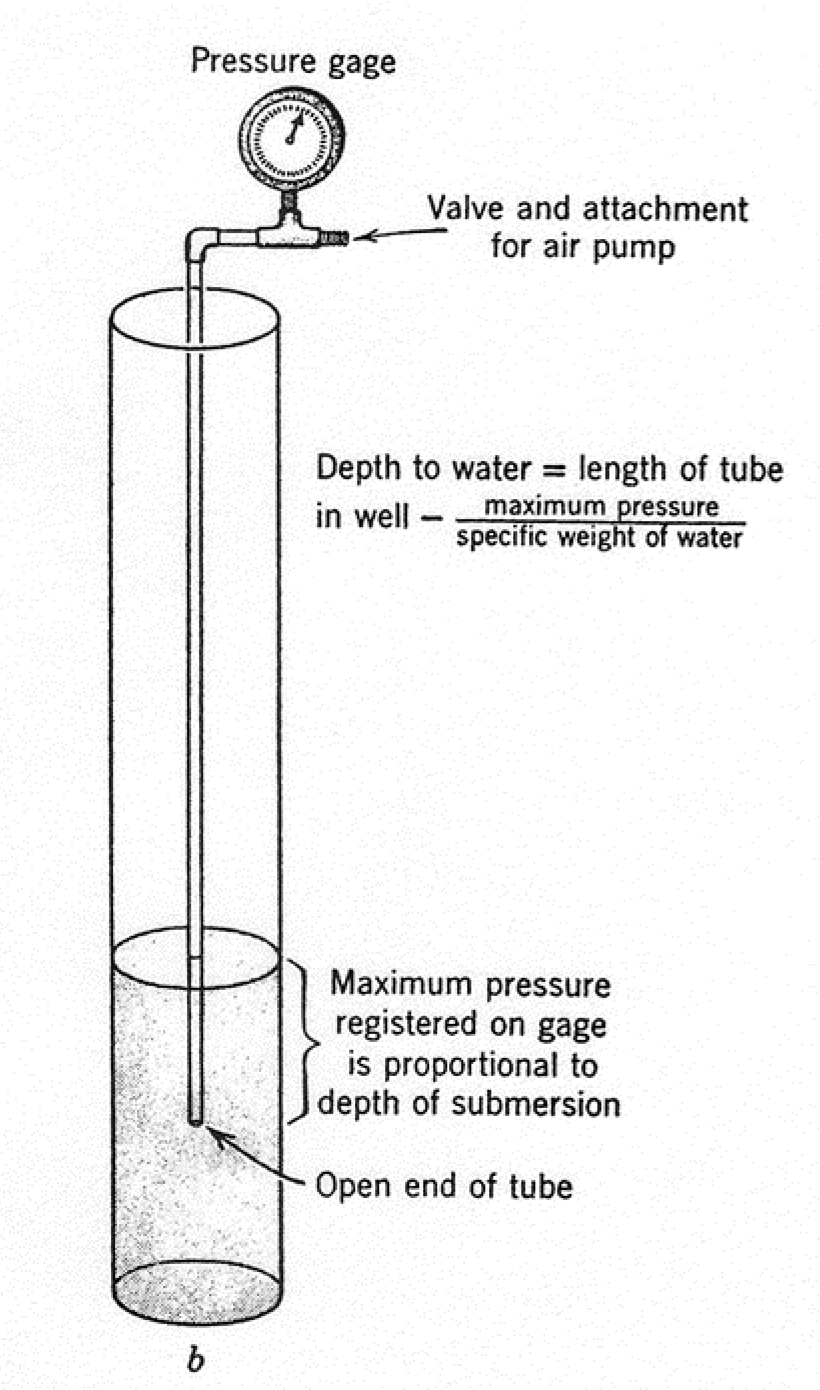
Chalked tape



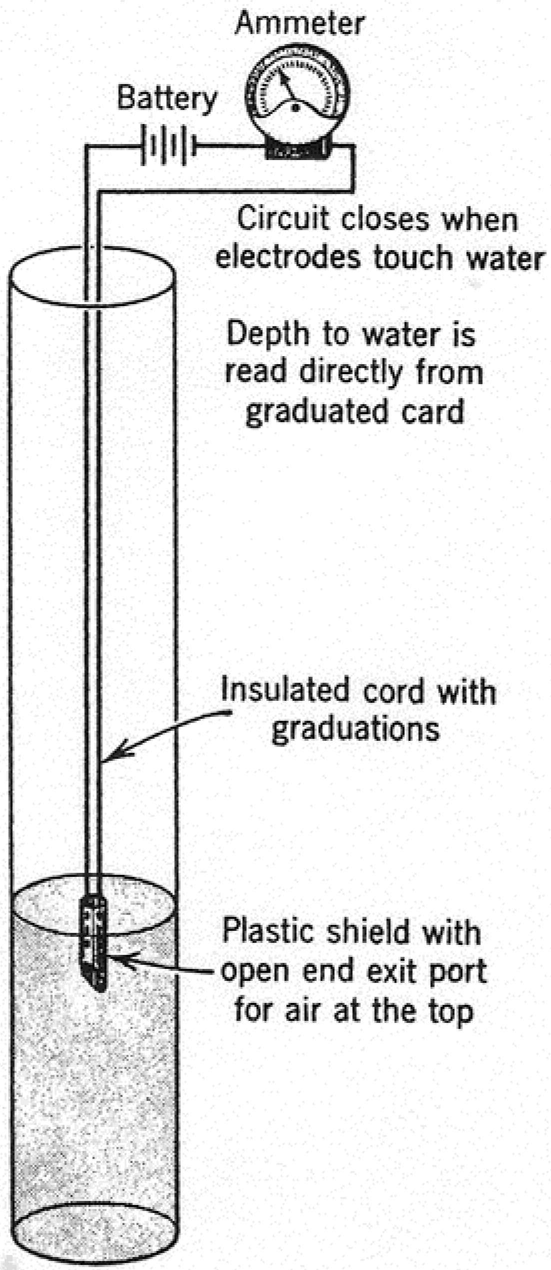
a

Depth to water = Reading at measuring point—wetted length

“Bubbler”

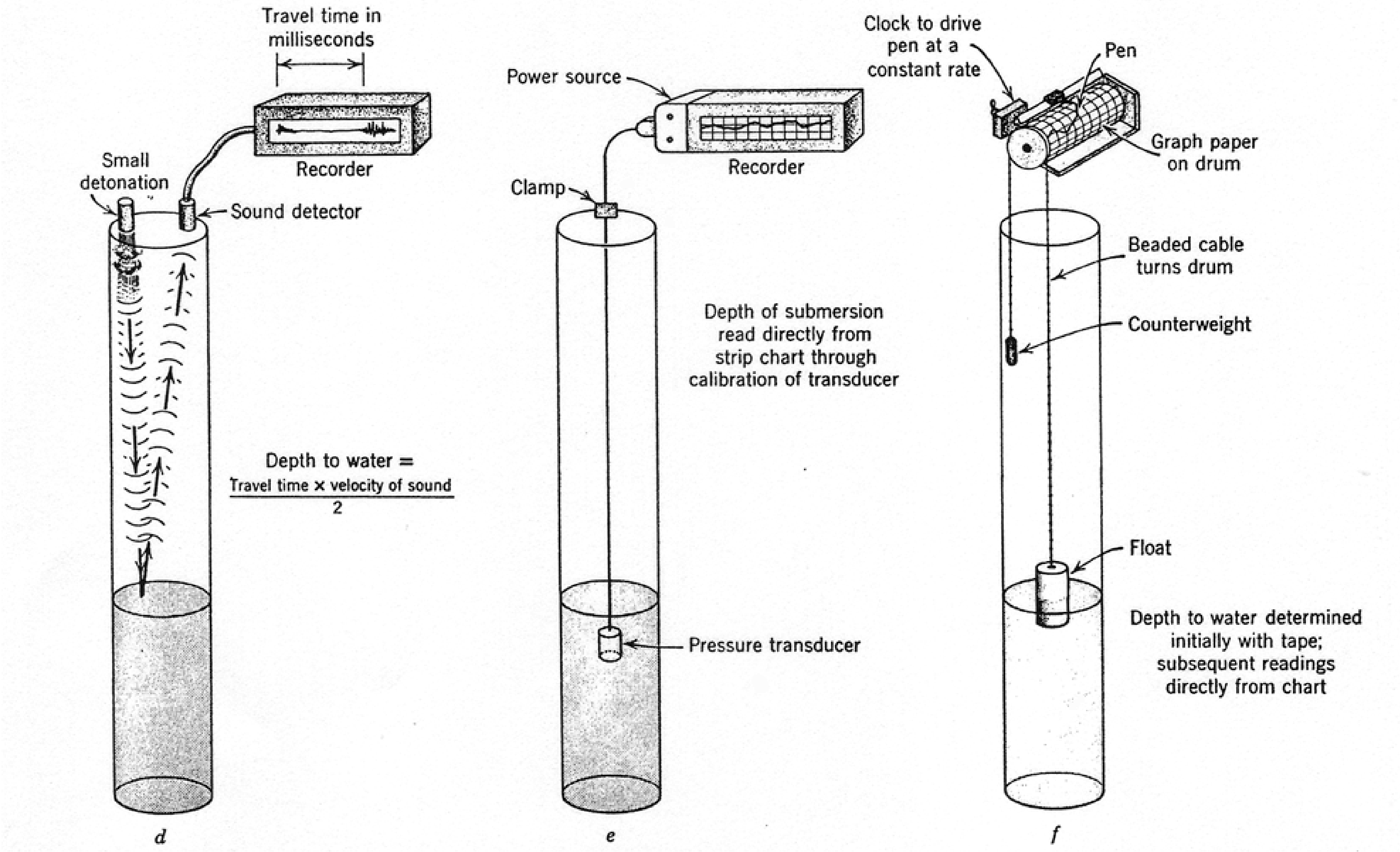

Pressure gage
Valve and attachment for air pump
Depth to water = length of tube in well − $\frac{\text{maximum pressure}}{\text{specific weight of water}}$
Maximum pressure registered on gage is proportional to depth of submersion
Open end of tube
b

Electrical contact



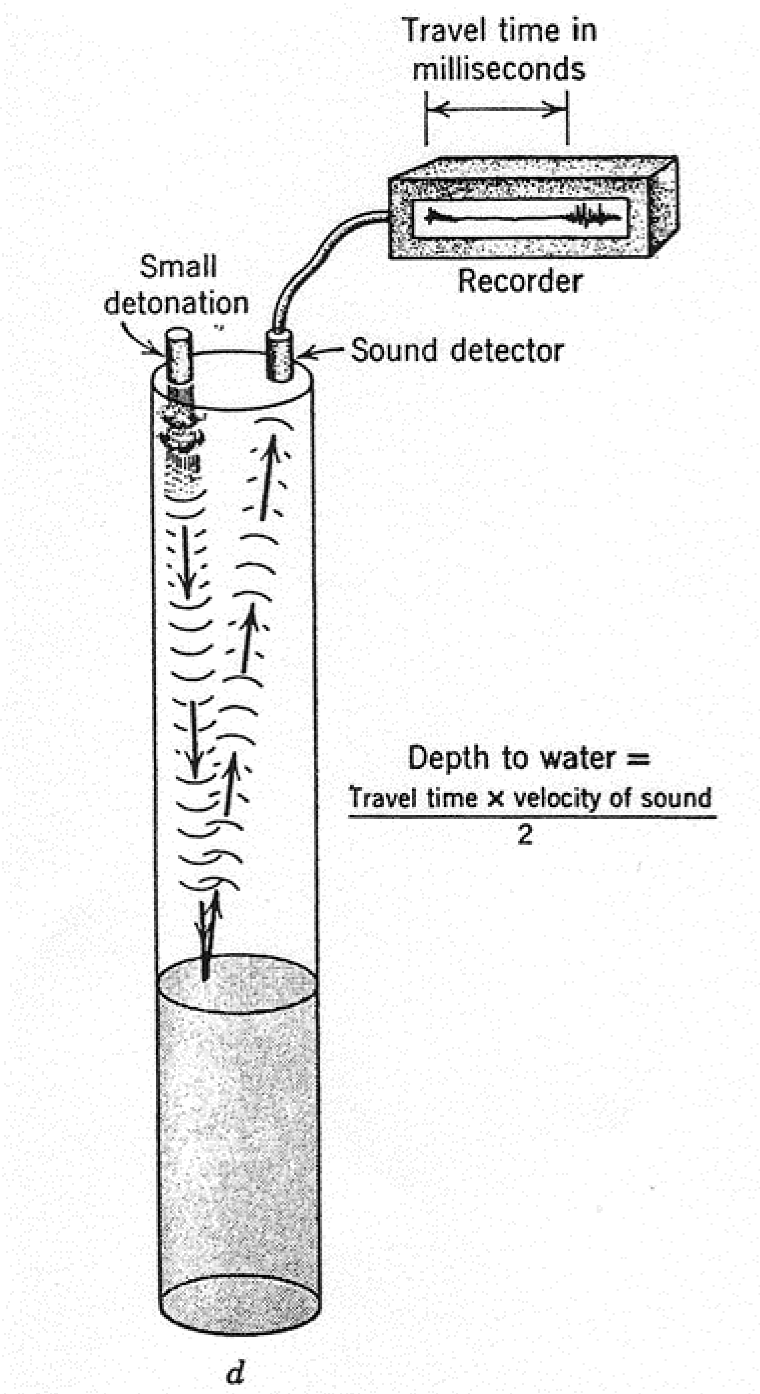
c

Strumenti per la misura di livello in pozzo

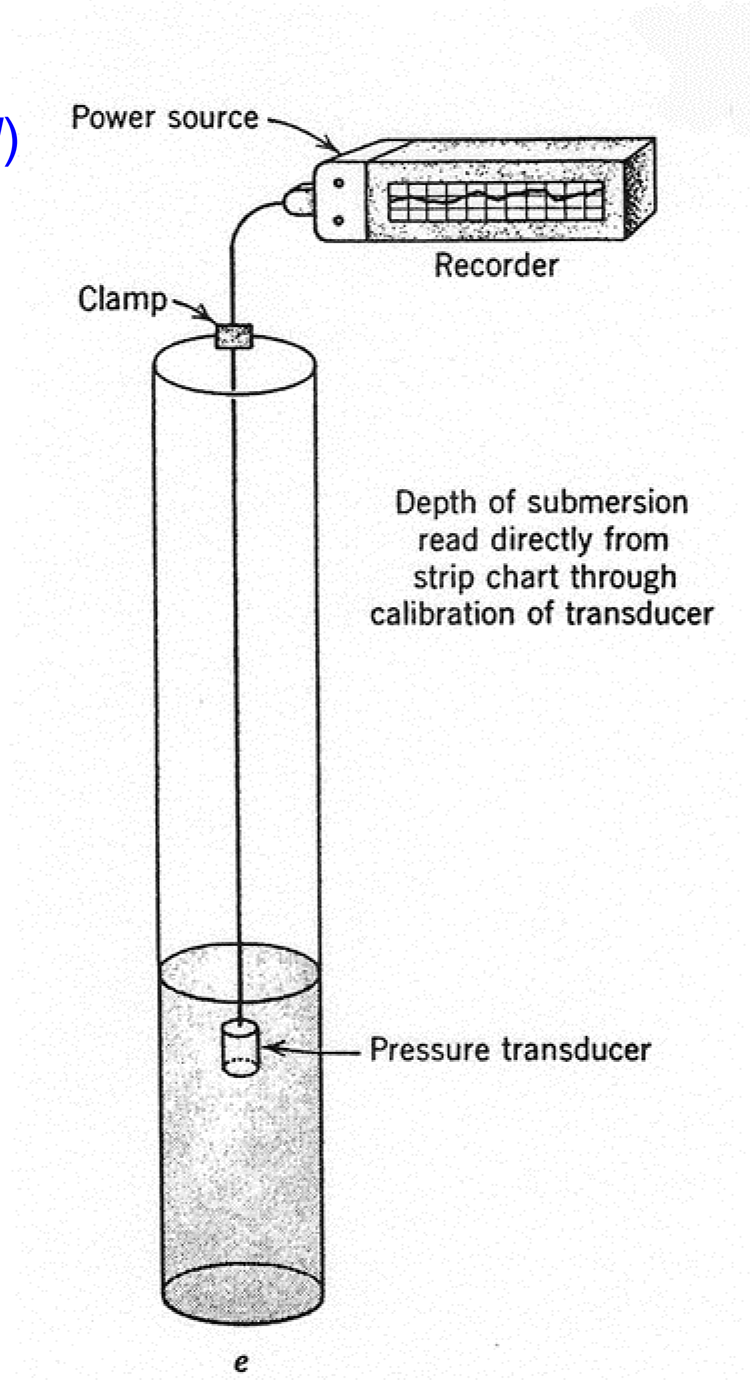


(*From: Fig. 2.28; Davis & DeWiest, 1966*)

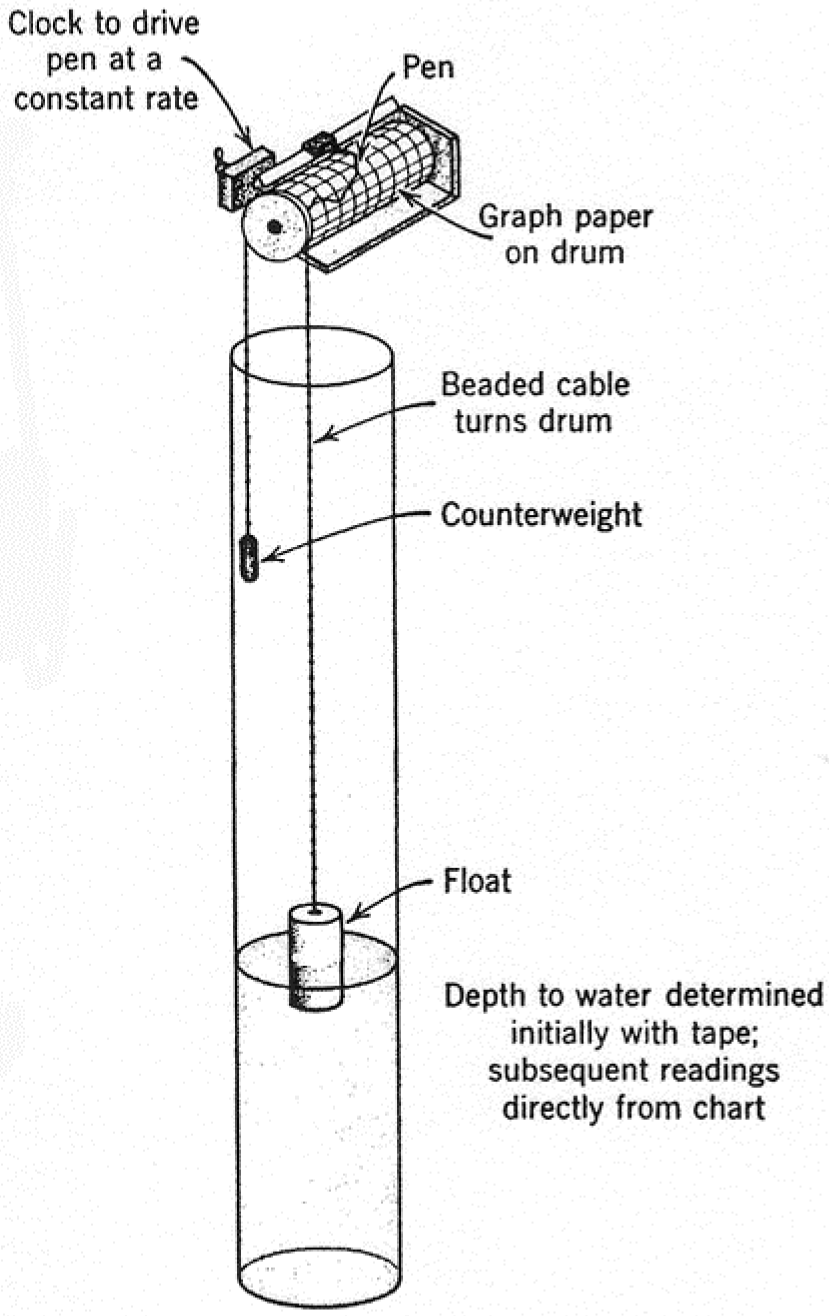
Sonic (Sound Pulse)



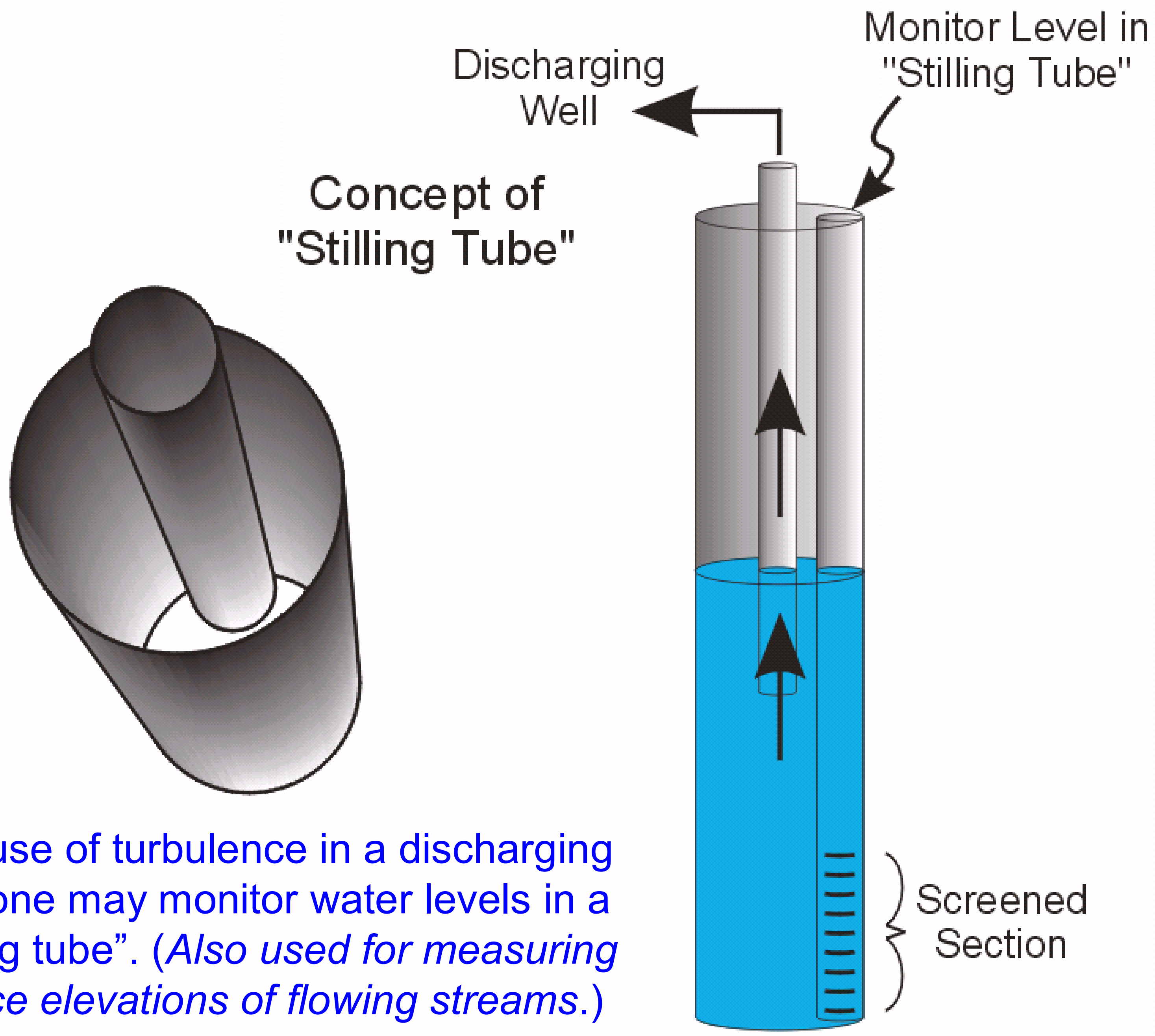
Pressure transducer
(*Vented or non-vented*)



Mechanical float & strip-chart recorder

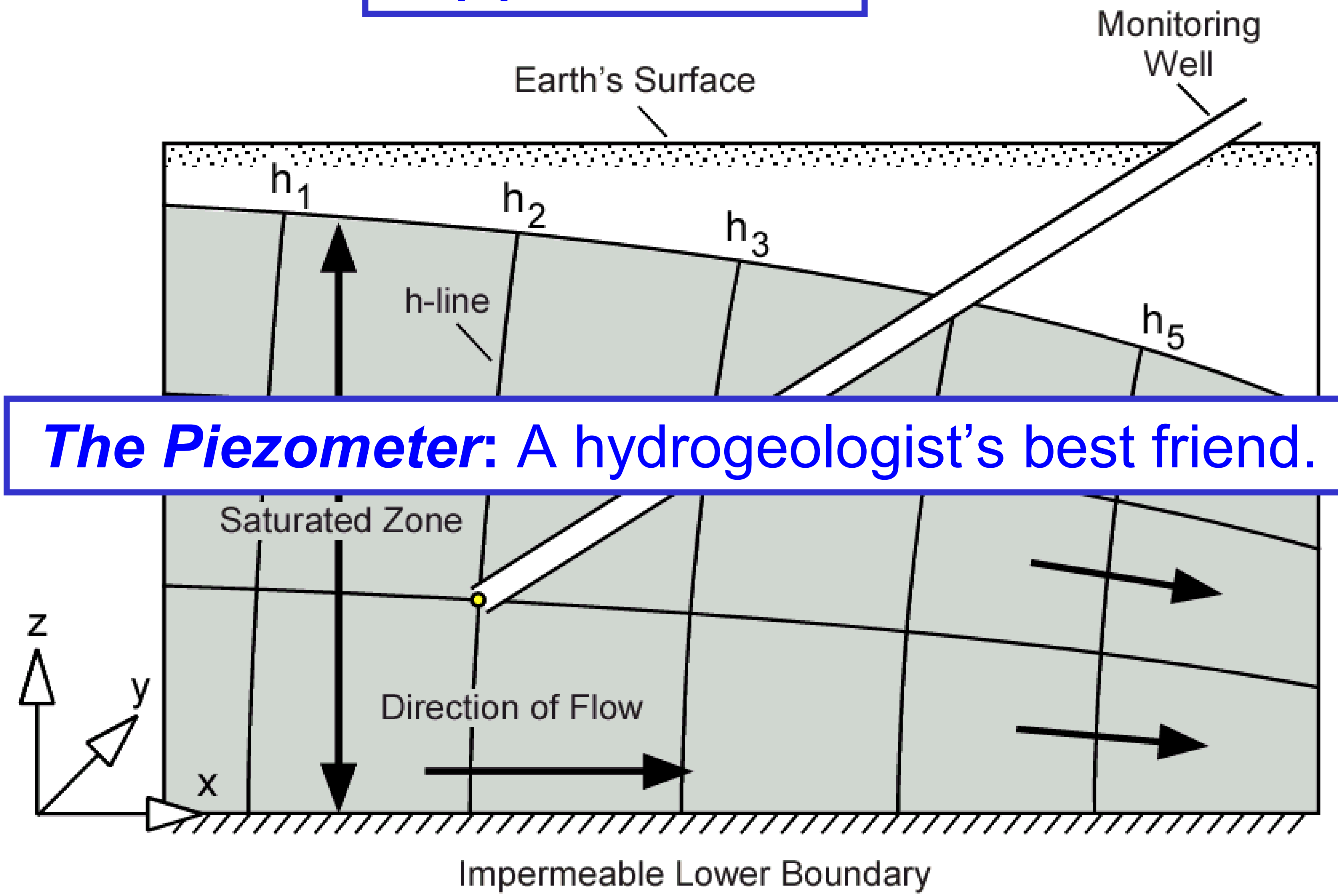


f

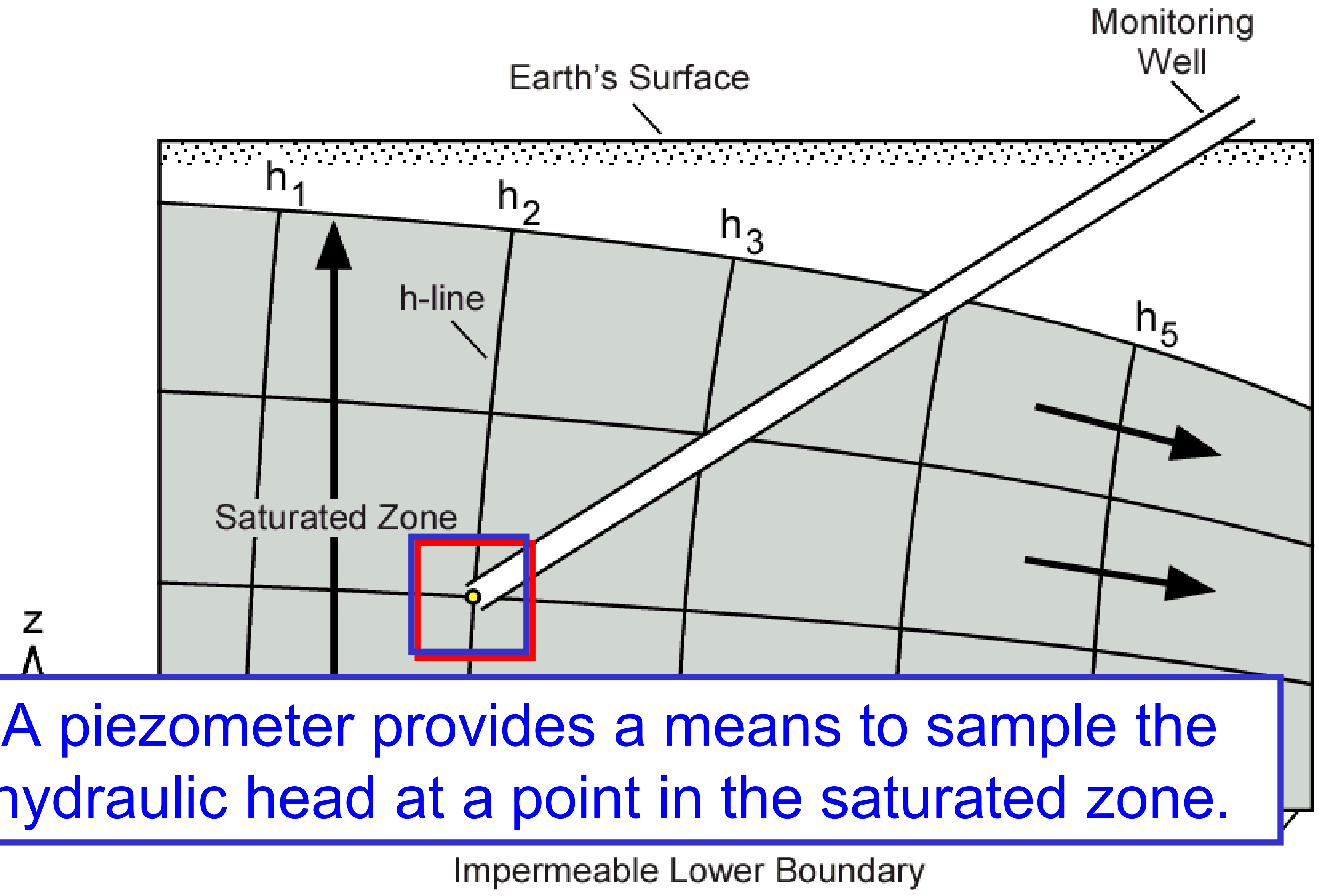


Because of turbulence in a discharging well, one may monitor water levels in a “stilling tube”. (*Also used for measuring surface elevations of flowing streams*.)

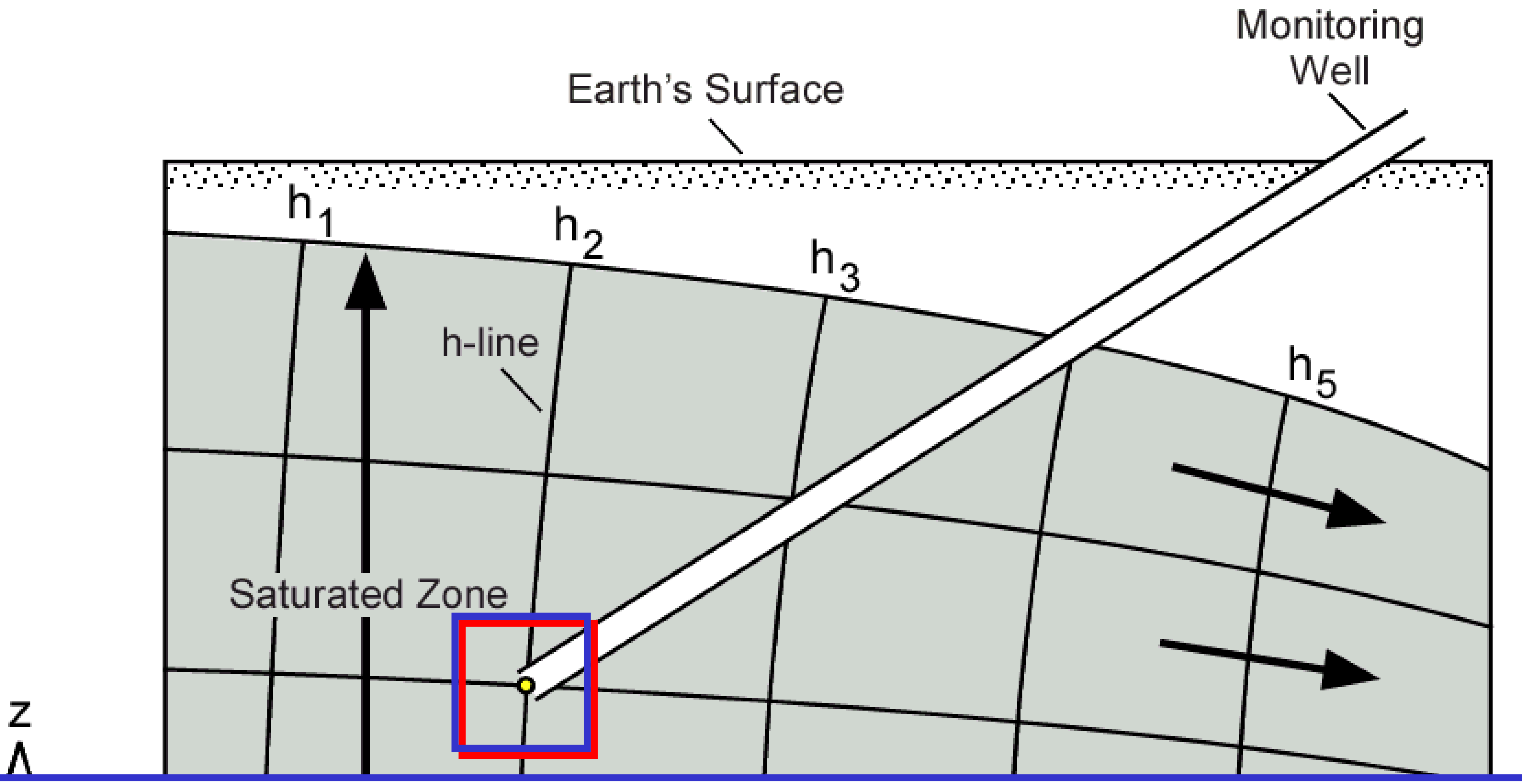
Applications



***The Piezometer*: A hydrogeologist's best friend.**

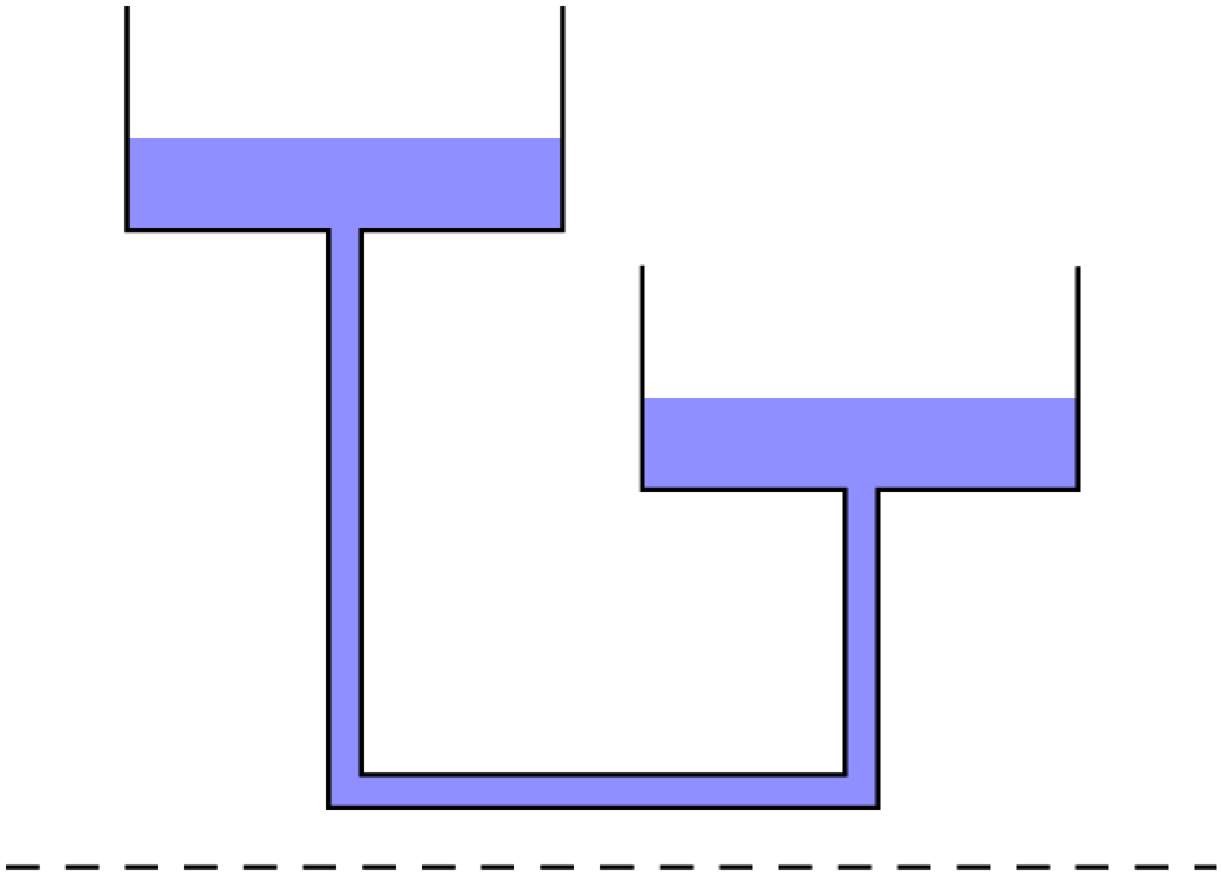


A piezometer provides a means to sample the hydraulic head at a point in the saturated zone.



Think of a piezometer as a long "insertion probe" to measure the pressure (pressure head) at a point.

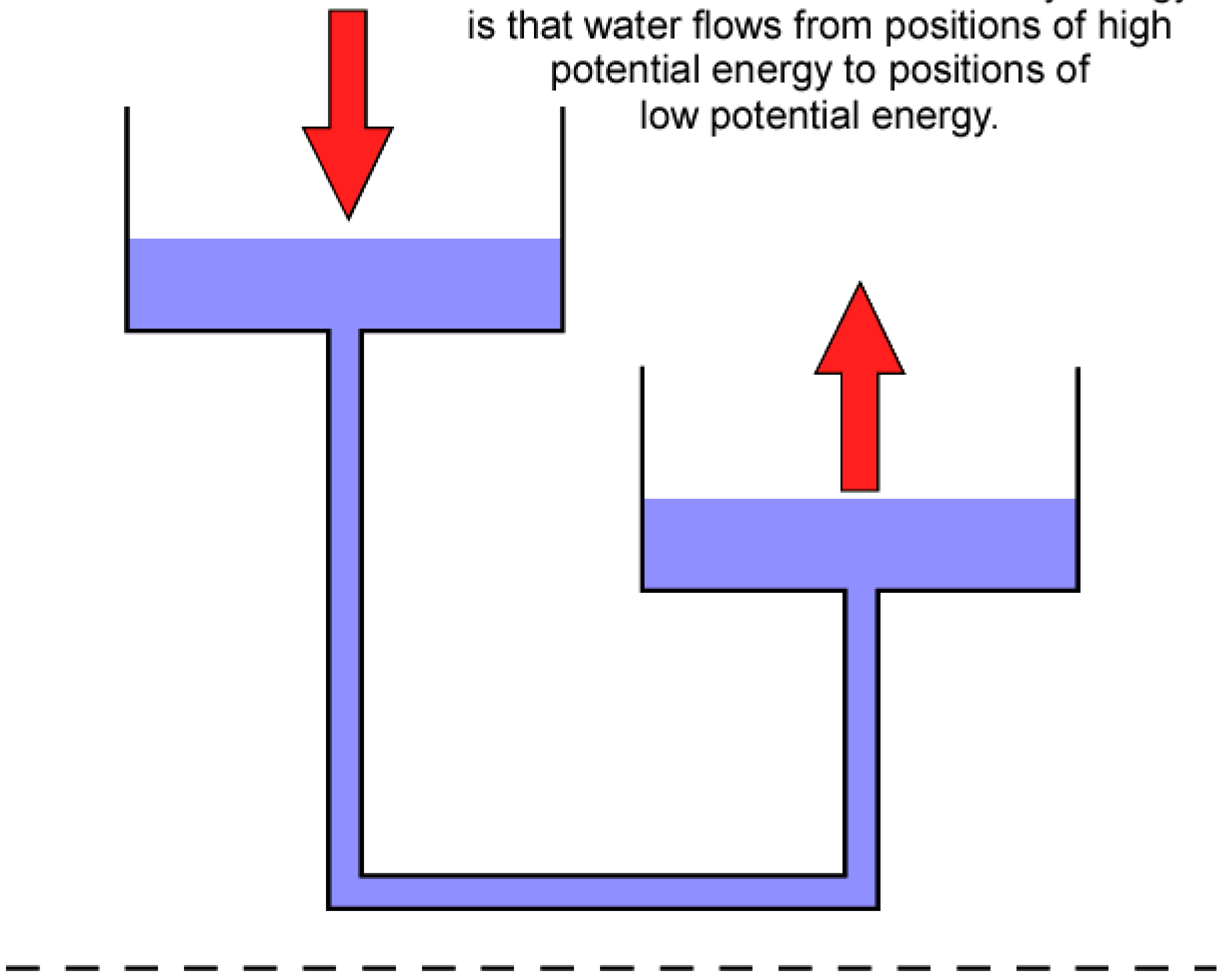
Fundamental Relations in Subsurface Flow



(*Reference or common “datum” plane*)

Fundamental Relations in Subsurface Flow

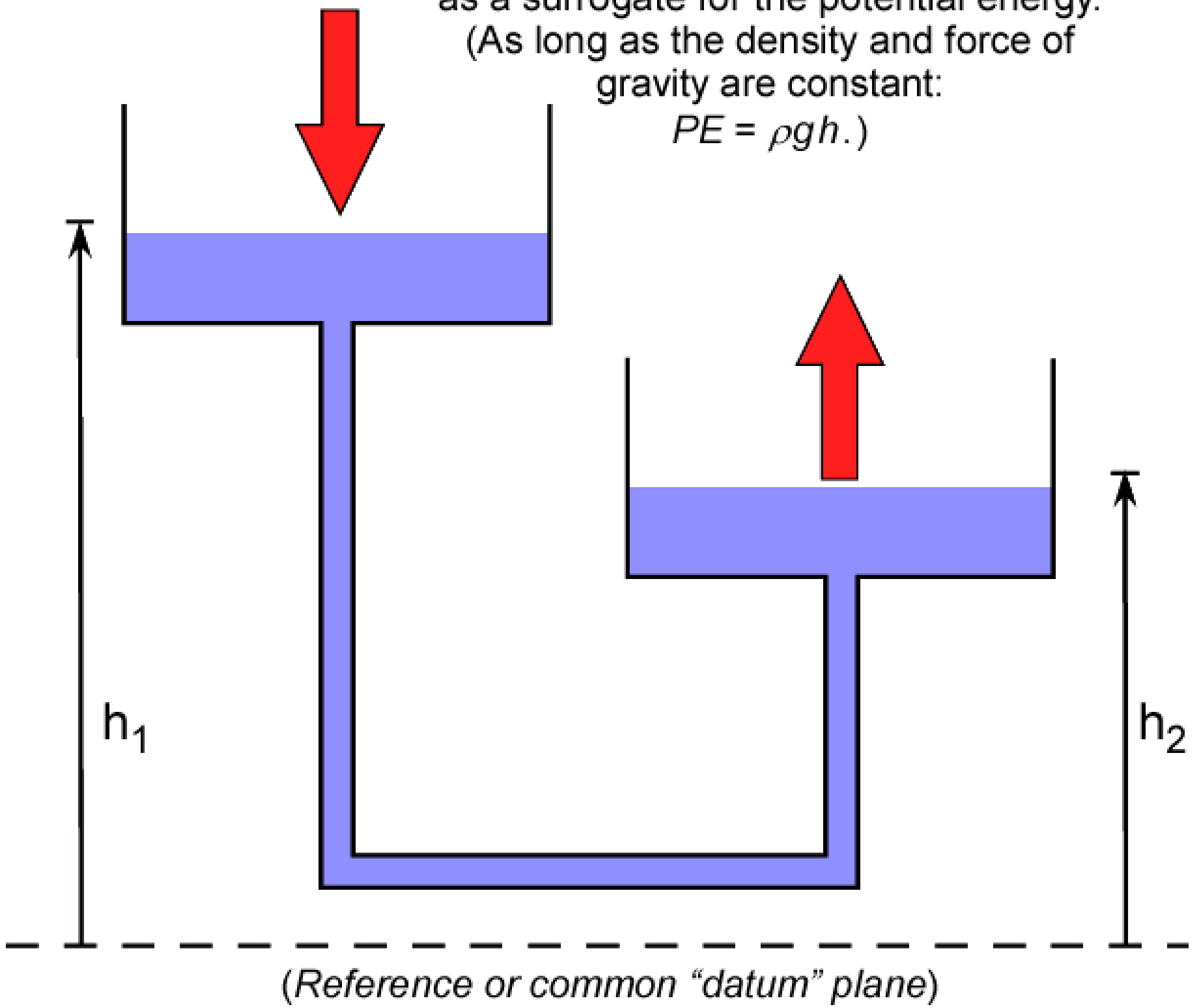
Recall that a fundamental law in hydrology is that water flows from positions of high potential energy to positions of low potential energy.



(*Reference or common "datum" plane*)

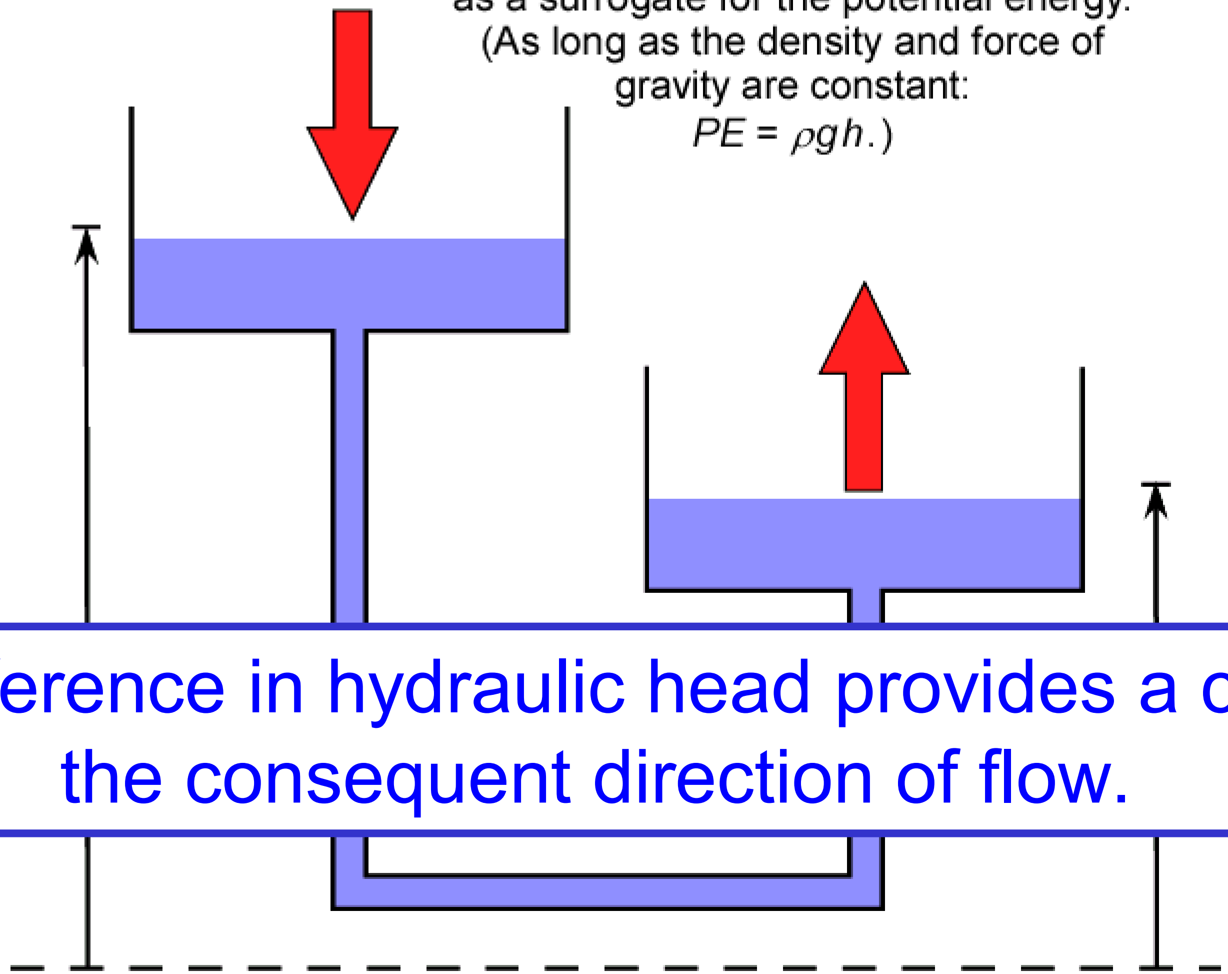
Fundamental Relations in Subsurface Flow

And recall that the hydraulic head can serve as a surrogate for the potential energy. (As long as the density and force of gravity are constant: $PE = \rho g h$.)



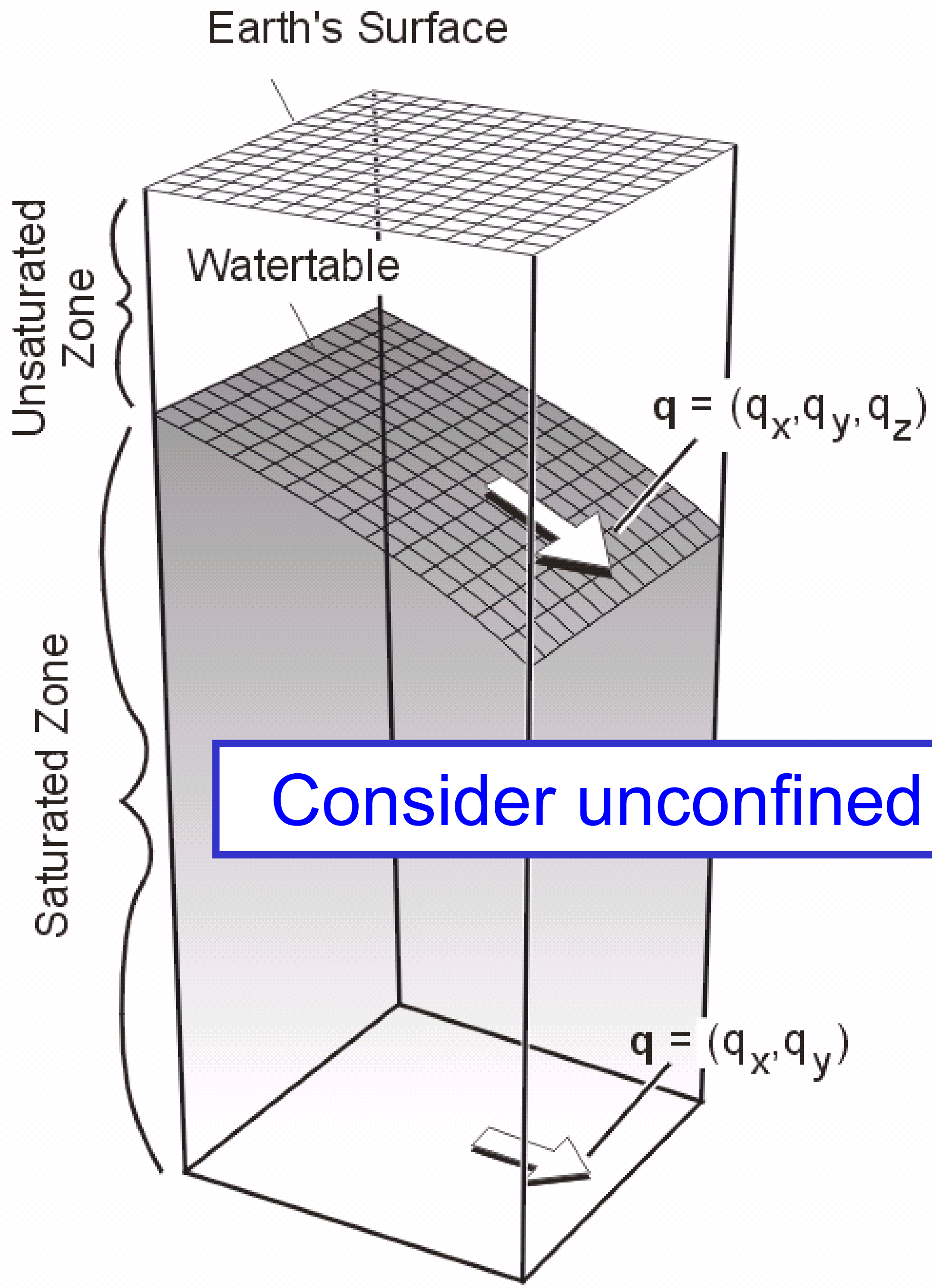
Fundamental Relations in Subsurface Flow

And recall that the hydraulic head can serve as a surrogate for the potential energy. (As long as the density and force of gravity are constant: $PE = \rho g h$.)



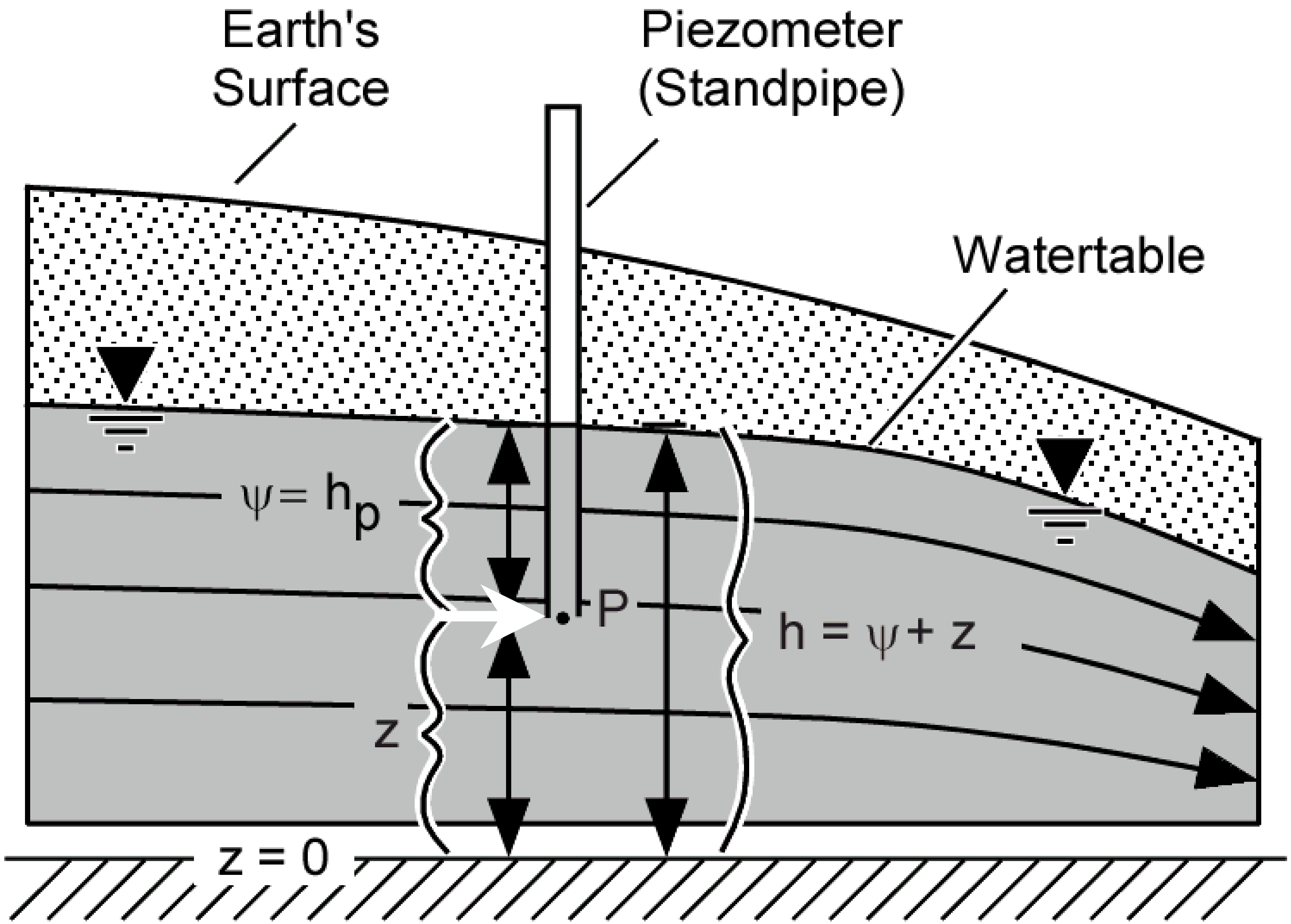
The difference in hydraulic head provides a clue for the consequent direction of flow.

(*Reference or common "datum" plane*)



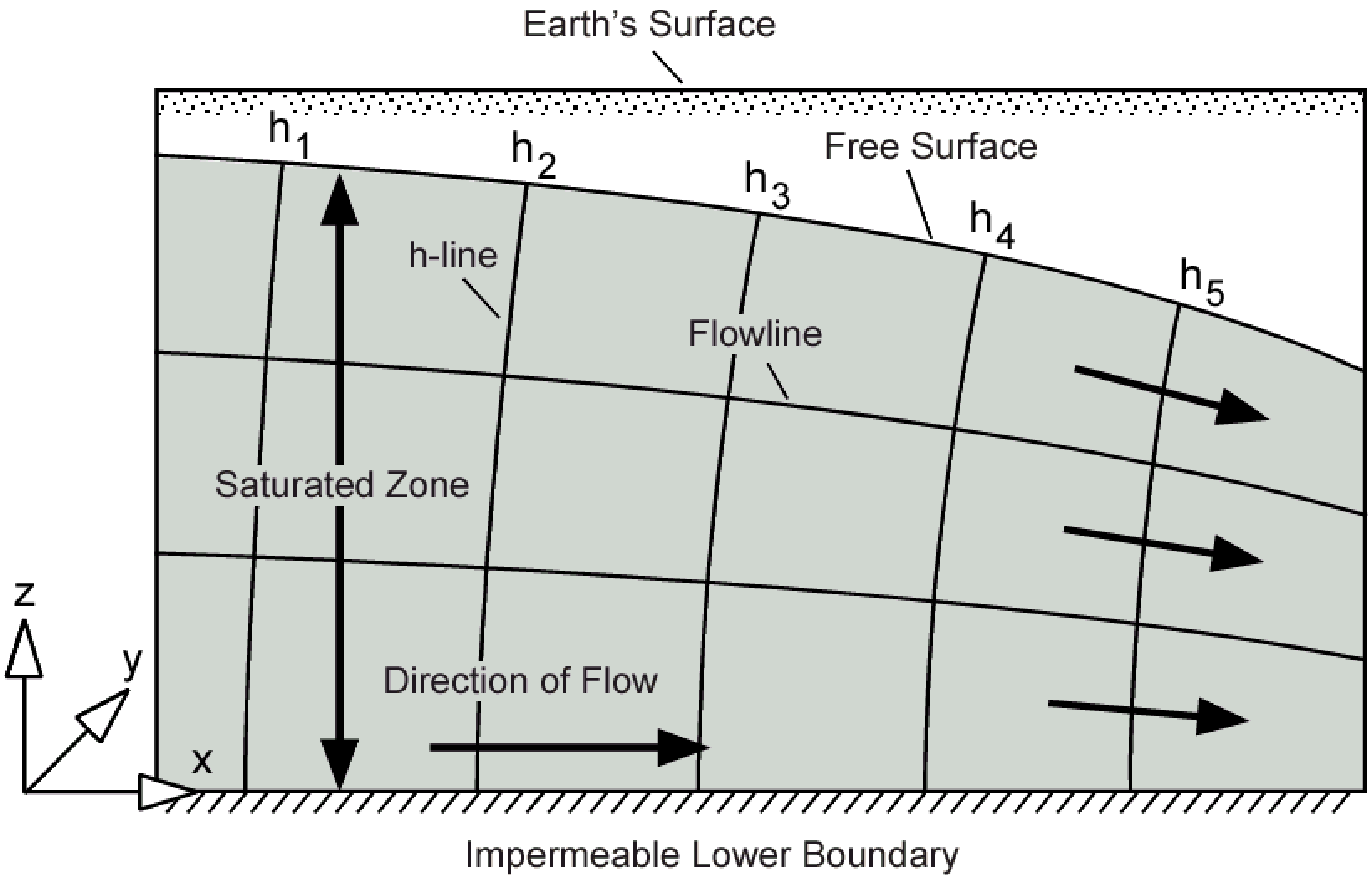
Consider unconfined flow.

A piezometer in operation: The elevation of water in the piezometer provides a measure of $h(P)$.

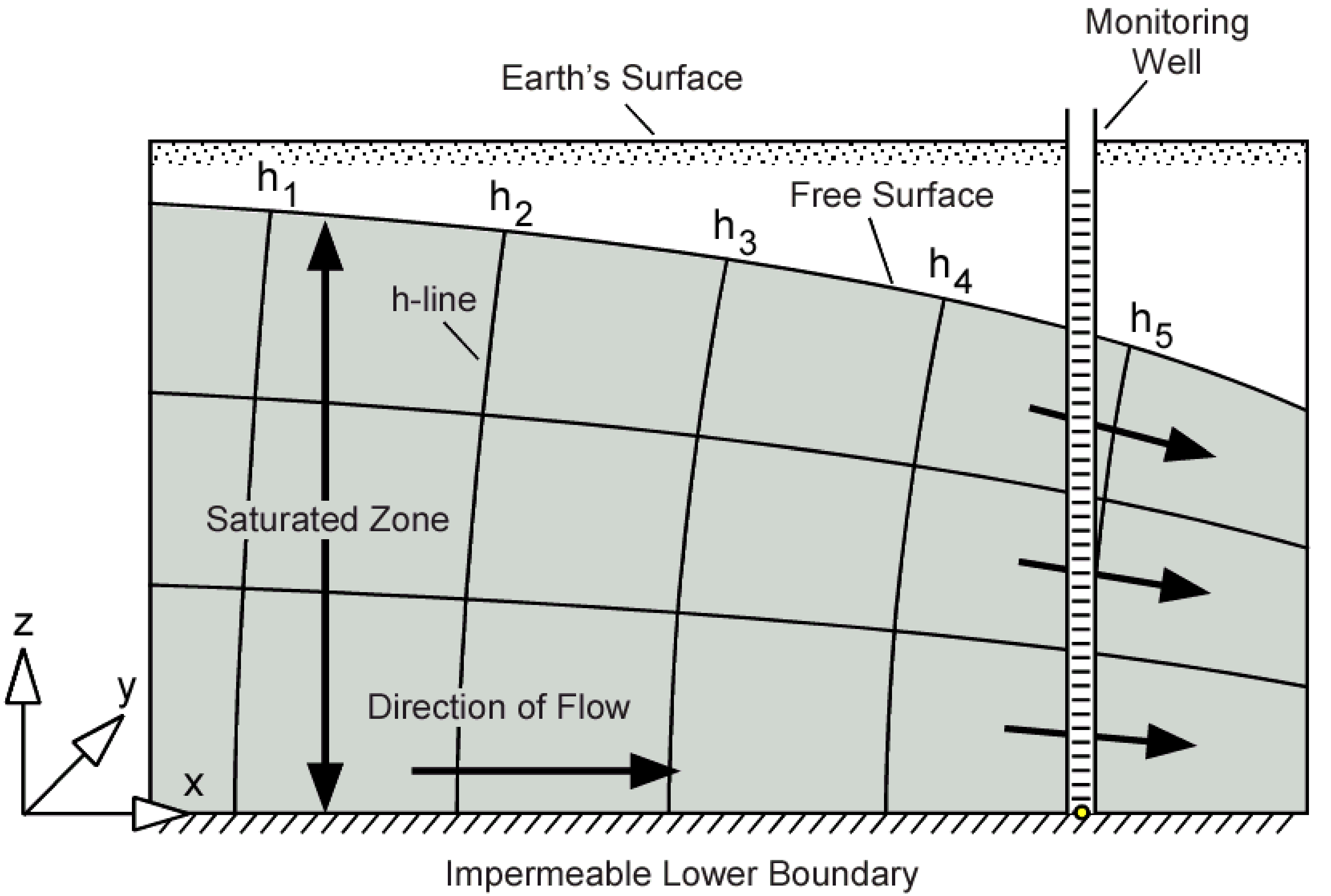


A piezometer measures the hydraulic head at a point.

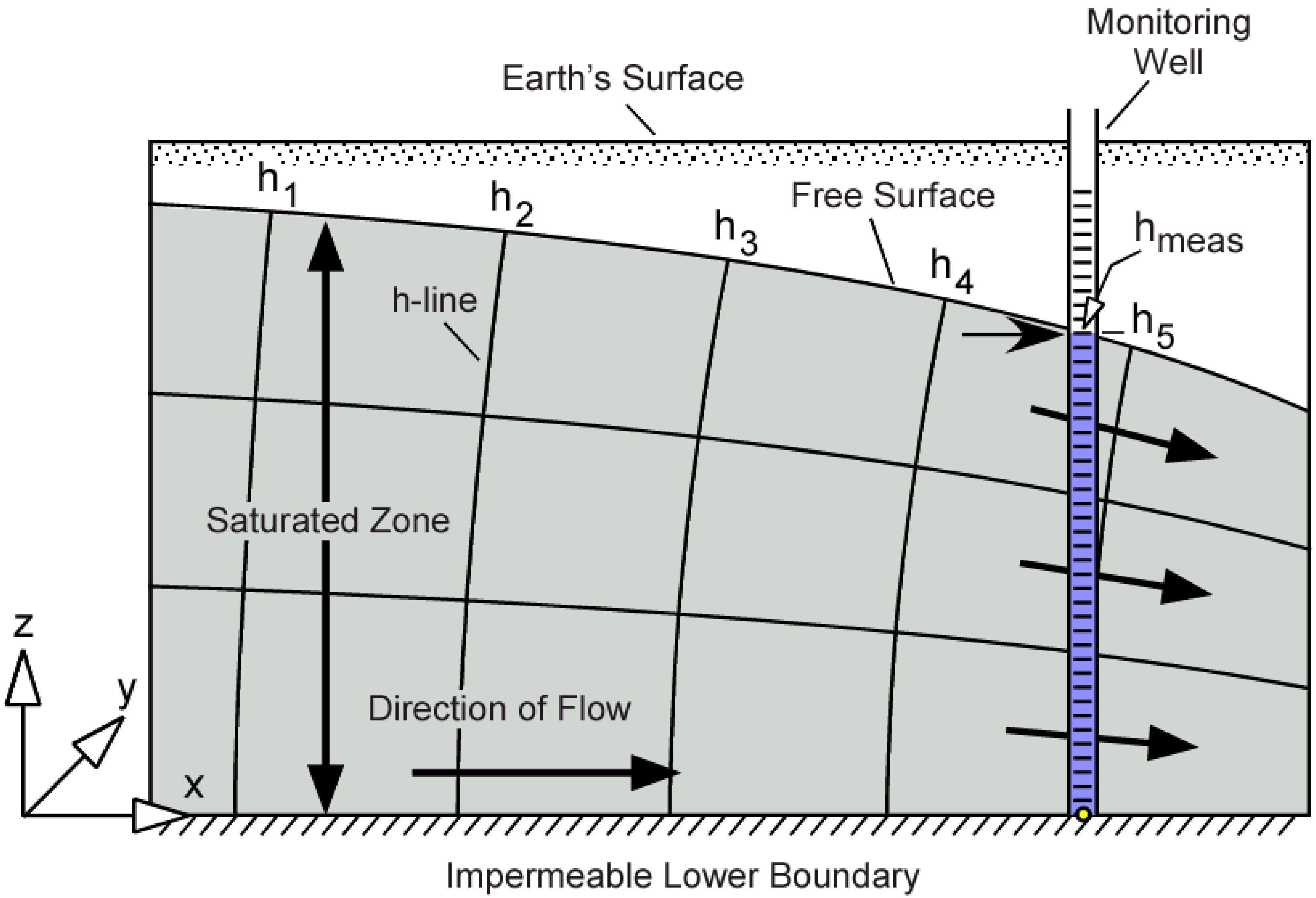
Example: Potentiometric surfaces (h-lines) for unconfined flow.



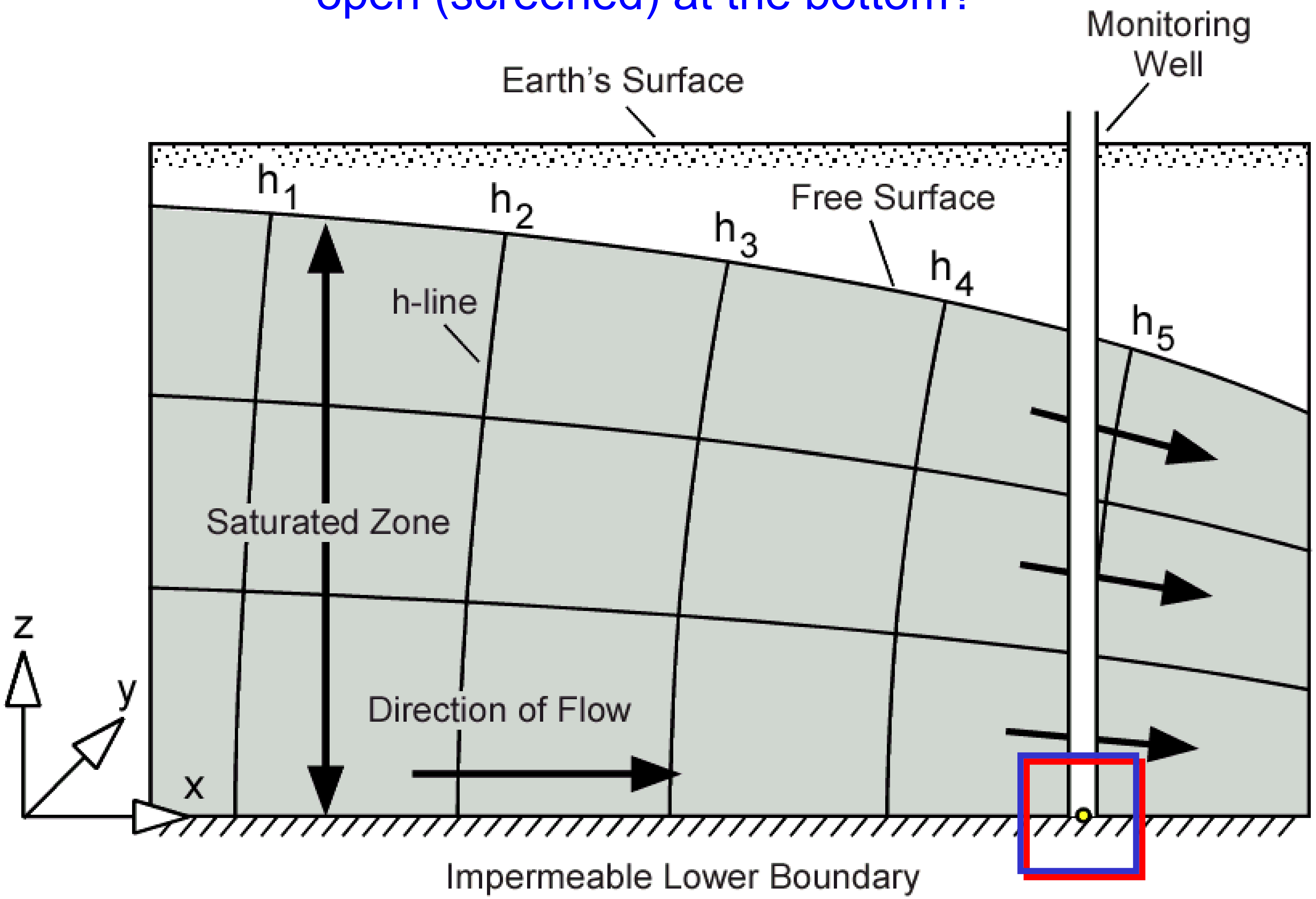
To what level does water rise in a vertical slotted (screened) well?



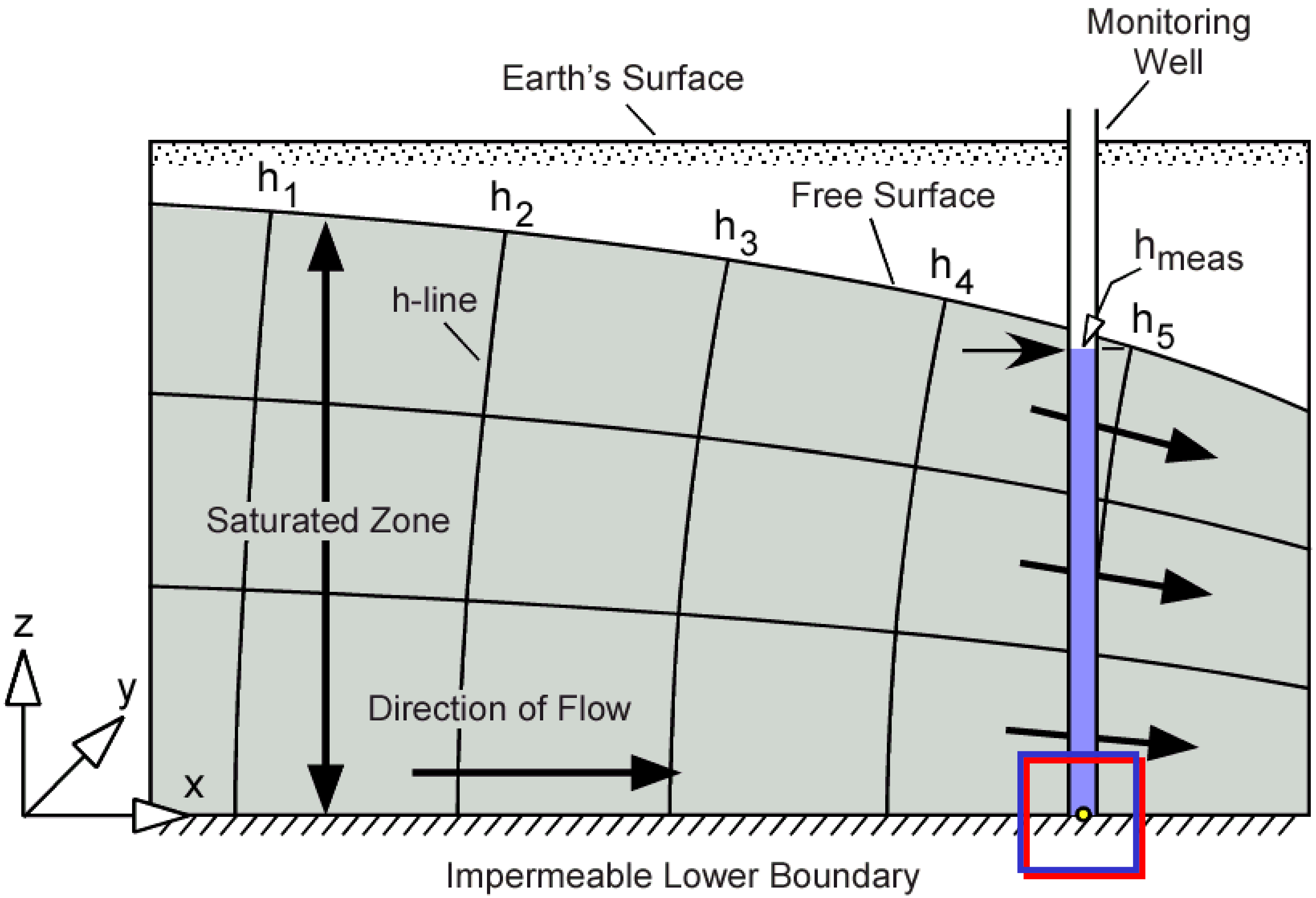
Questions – comments?

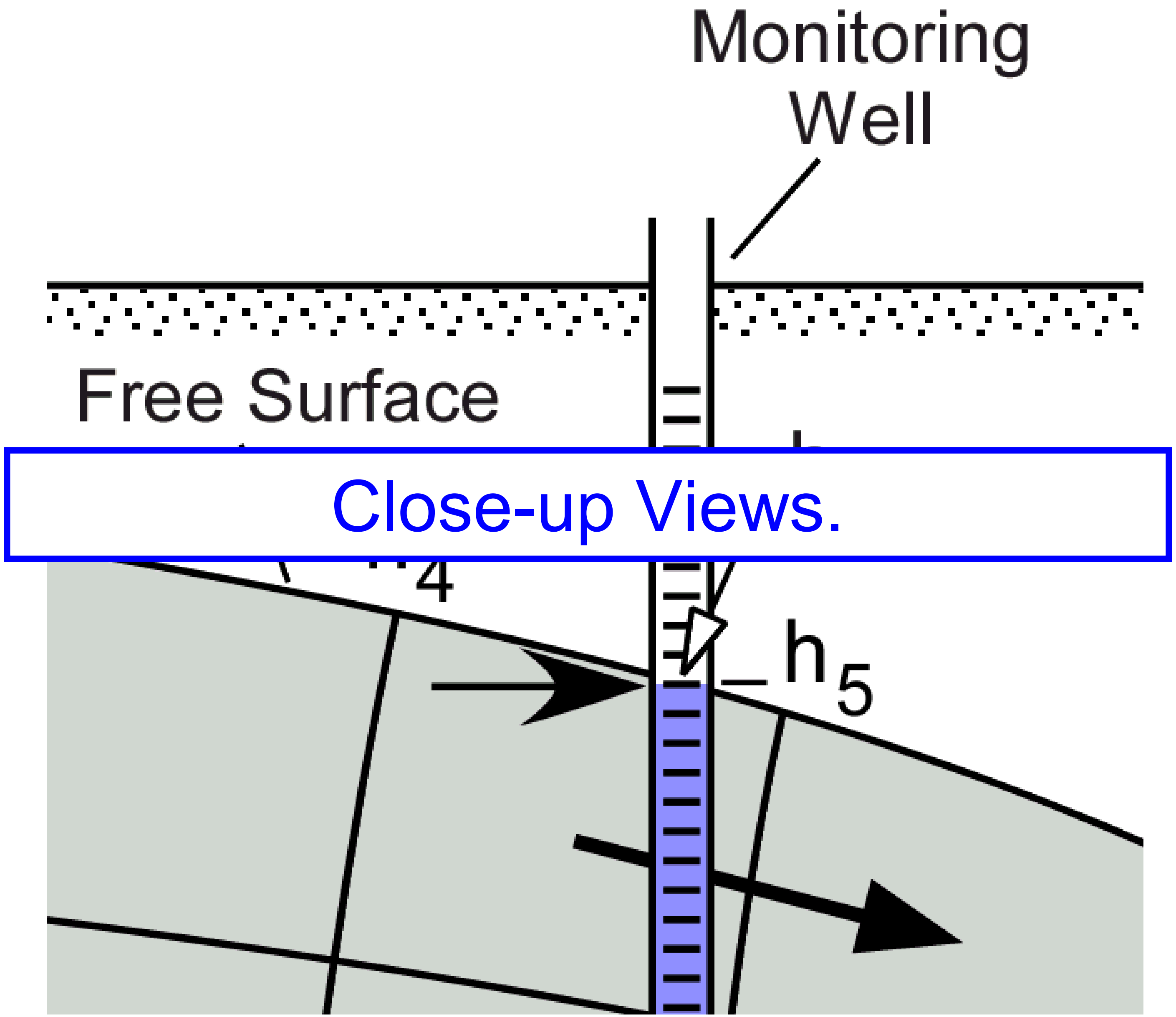


To what level does water rise in a vertical, continuously-cased well, open (screened) at the bottom?

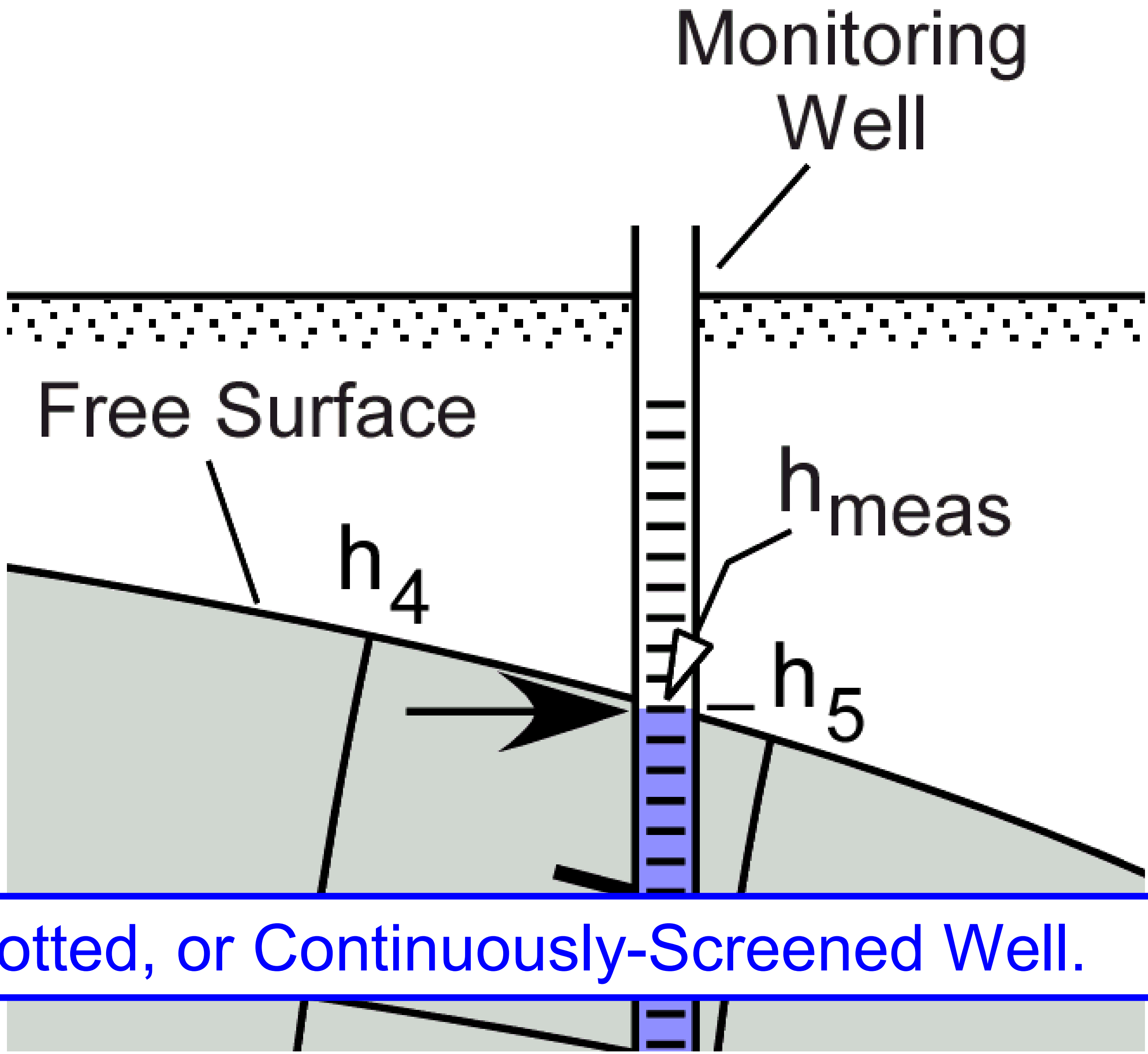


Questions – comments?

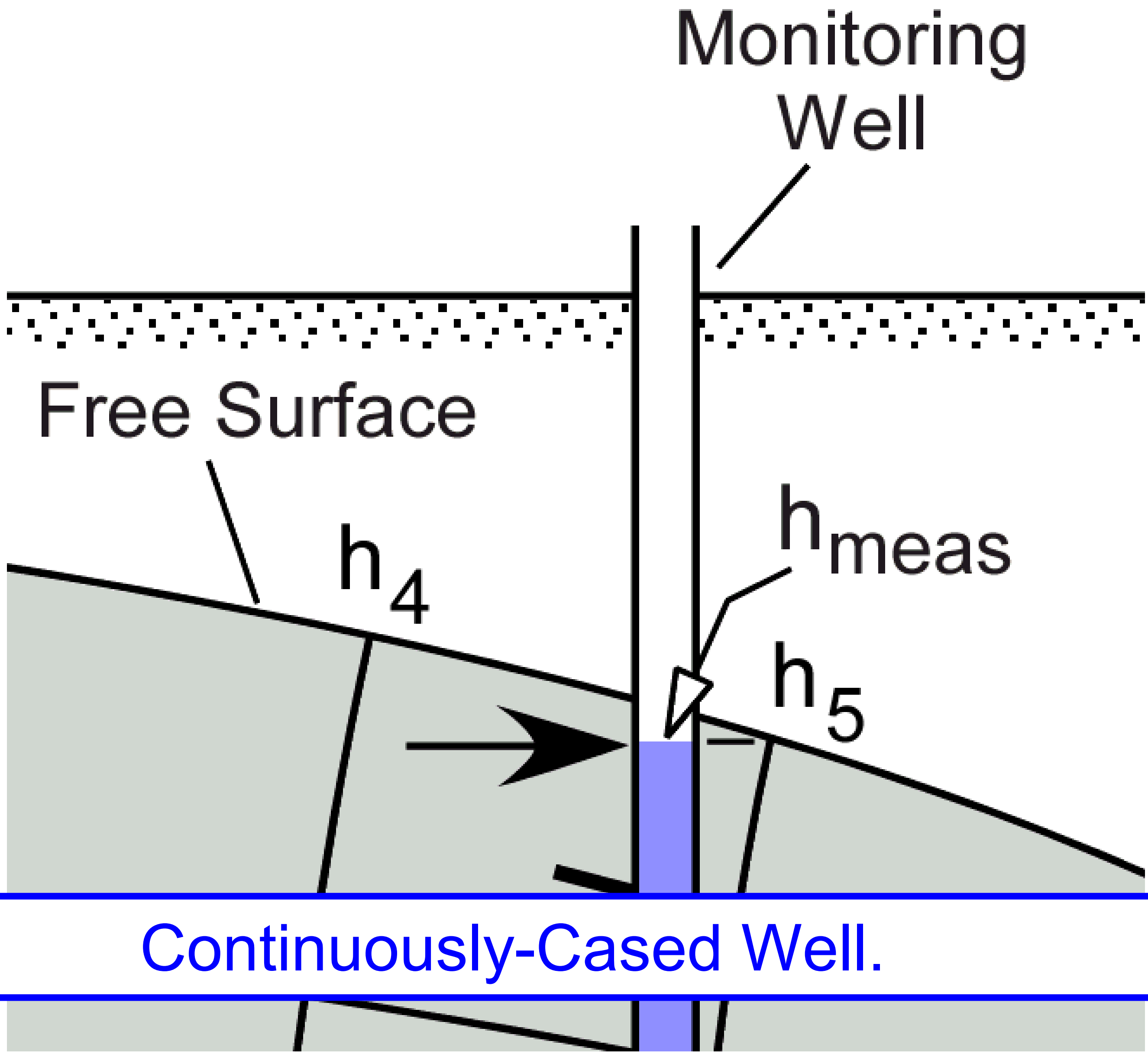




Monitoring Well
Free Surface
h
h
4
h
5
Close-up Views.

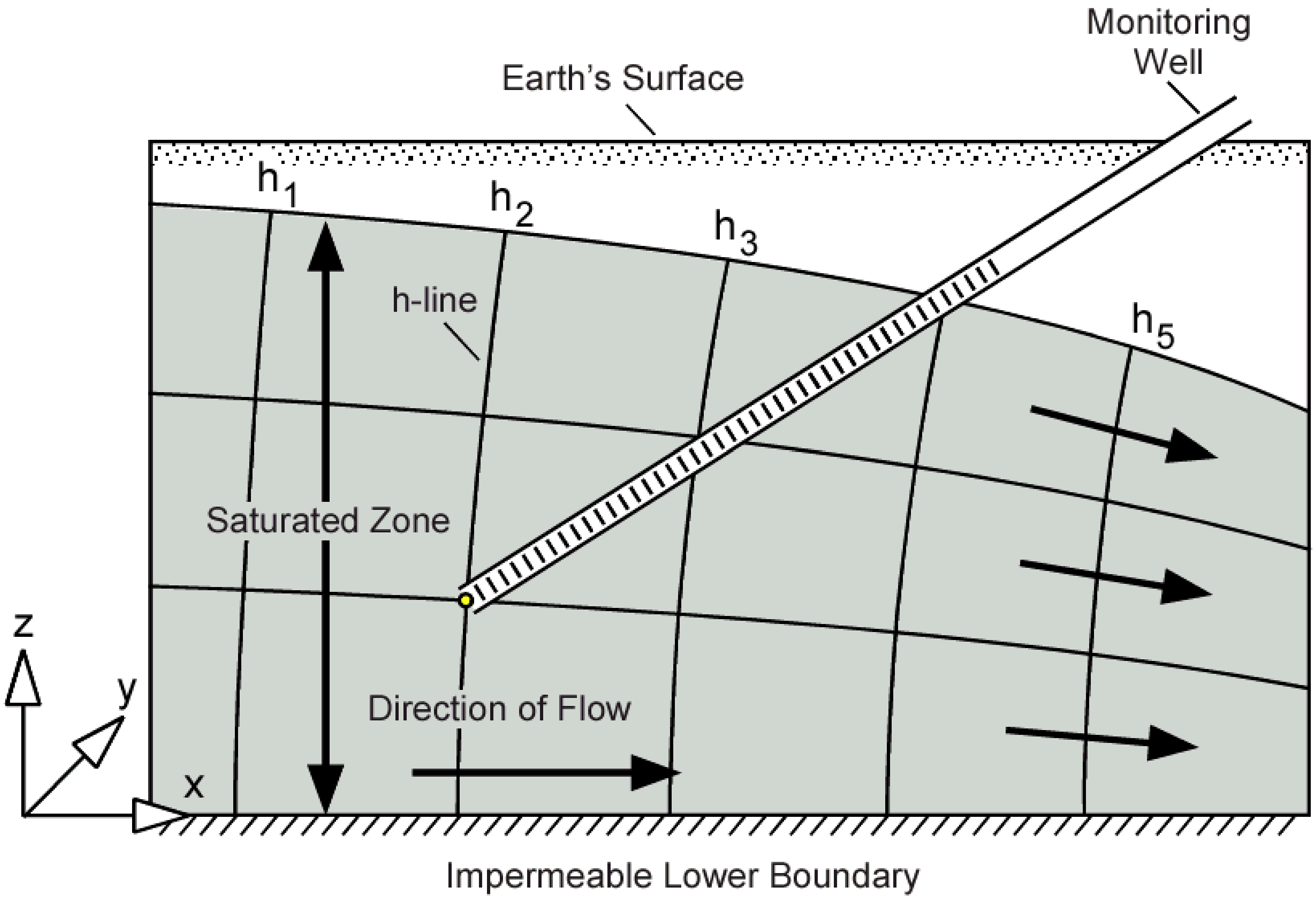


Slotted, or Continuously-Screened Well.

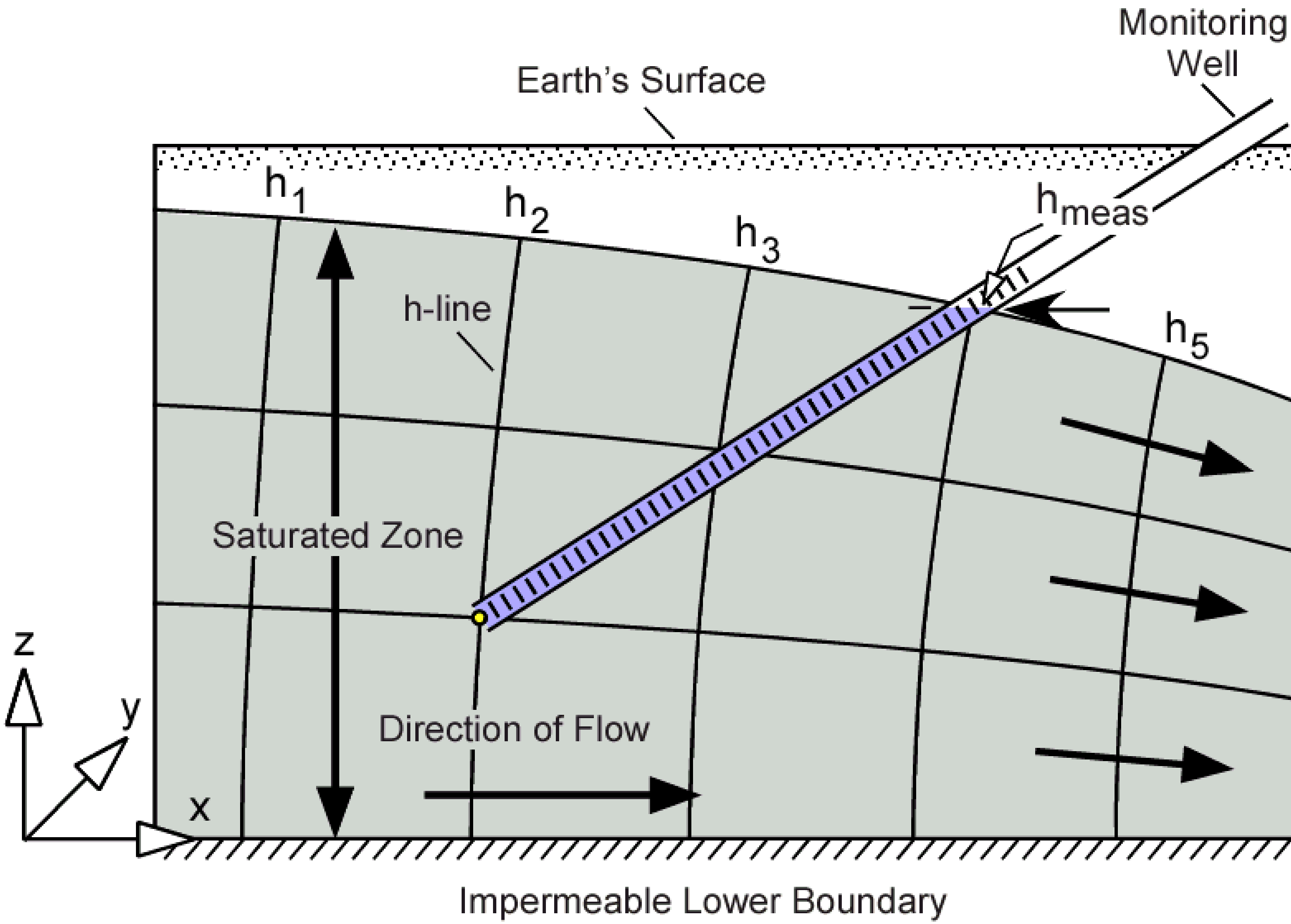


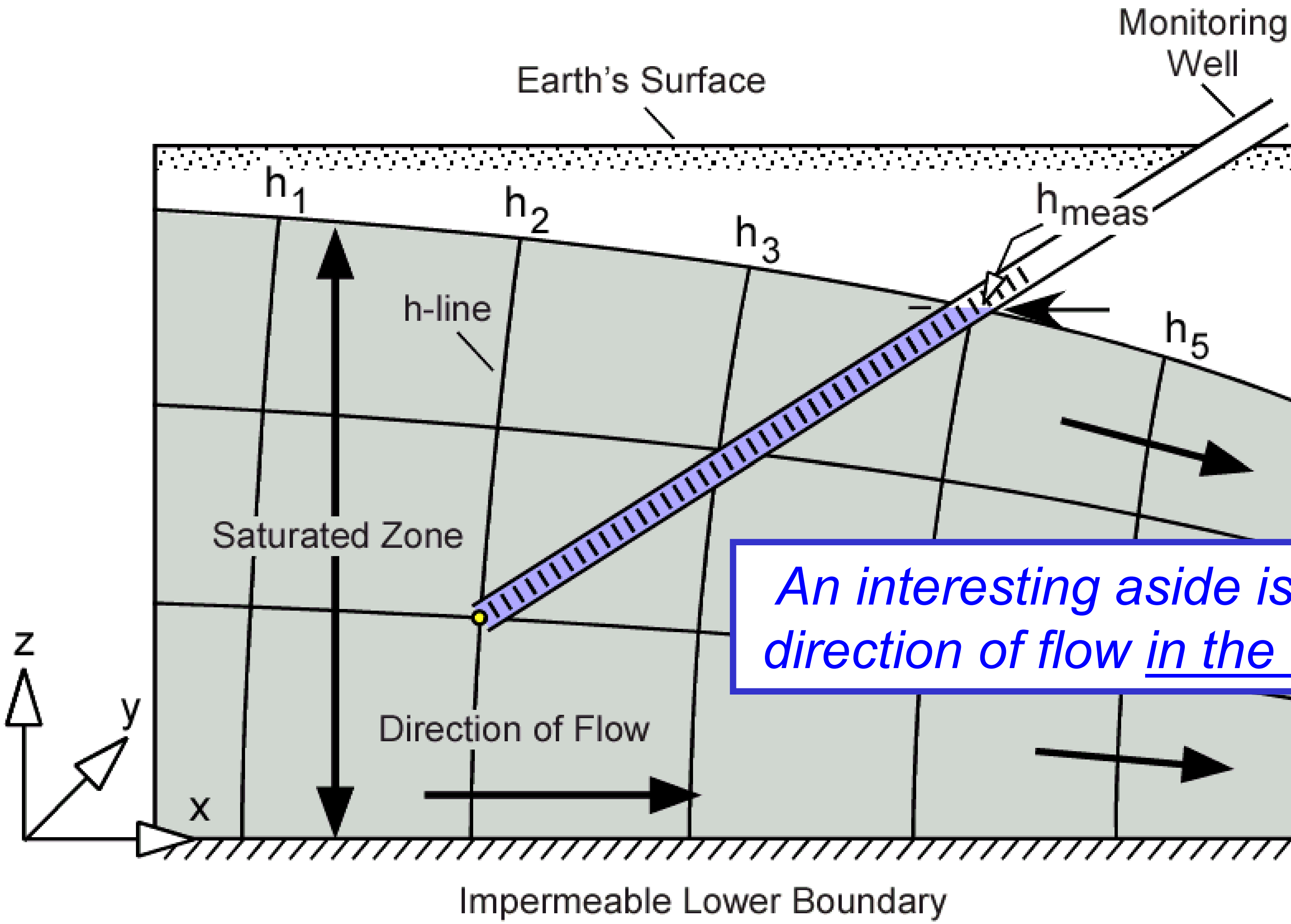
Continuously-Cased Well.

To what level does water rise in a slanted, slotted (screened) well?



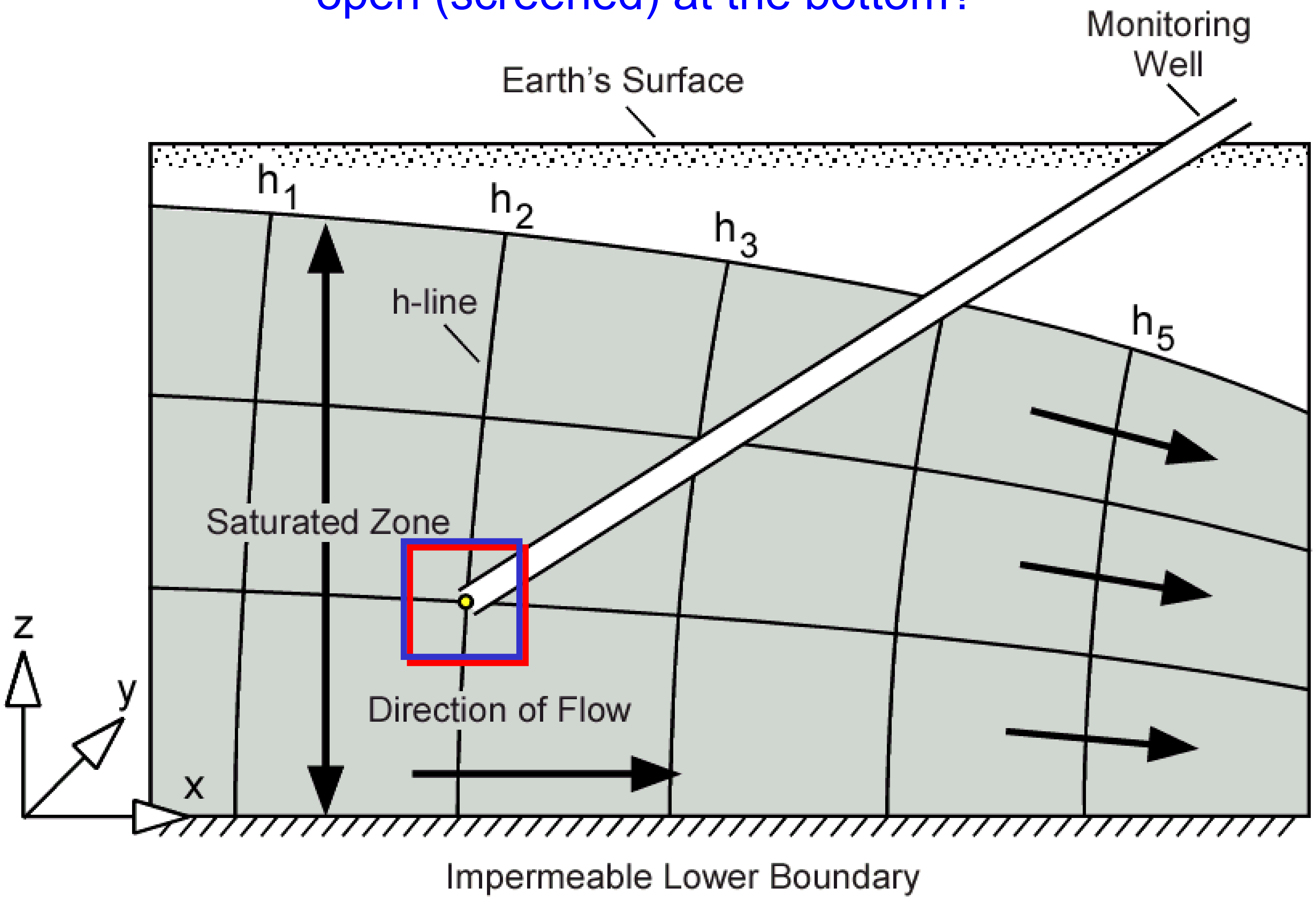
Questions – comments?



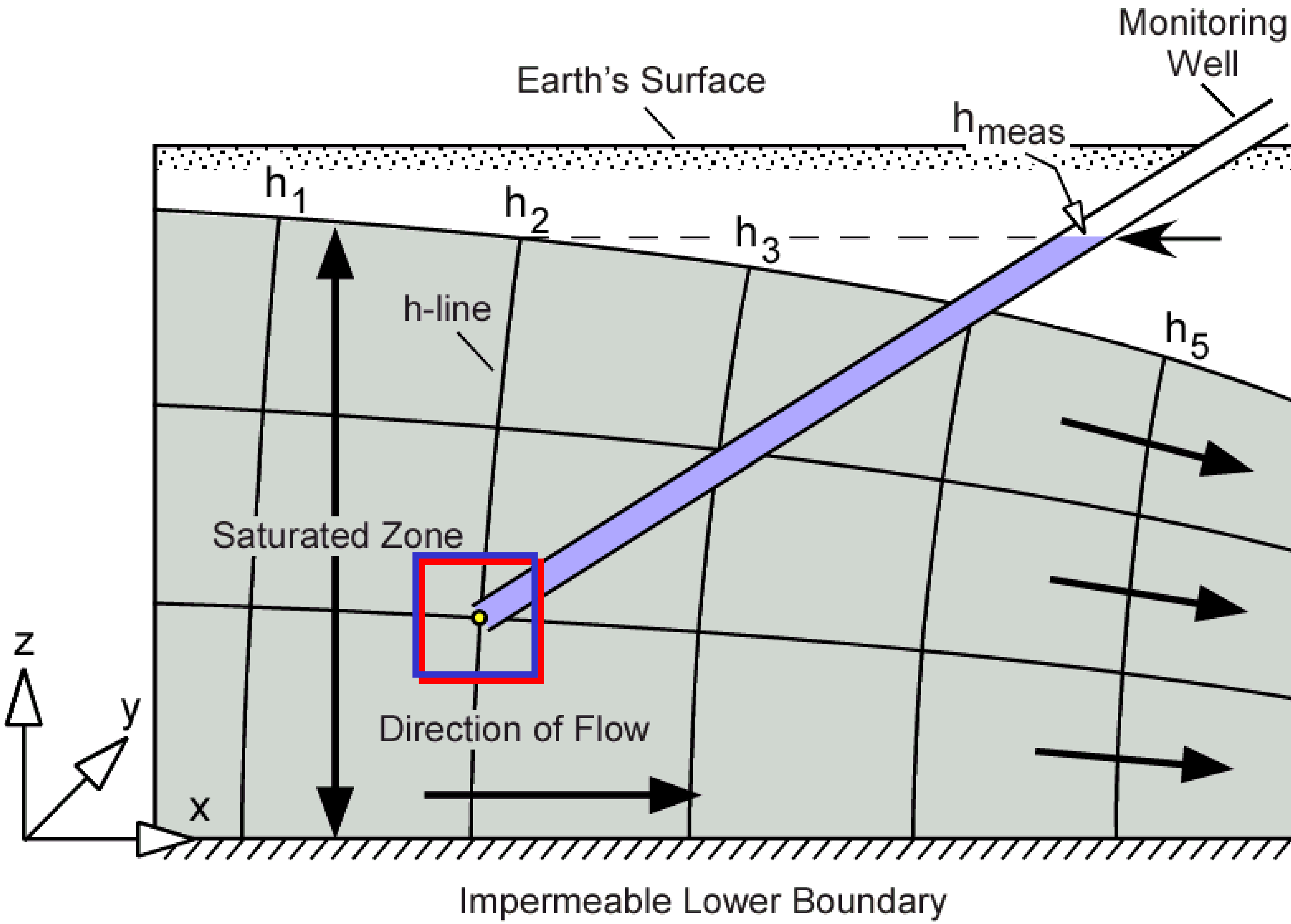


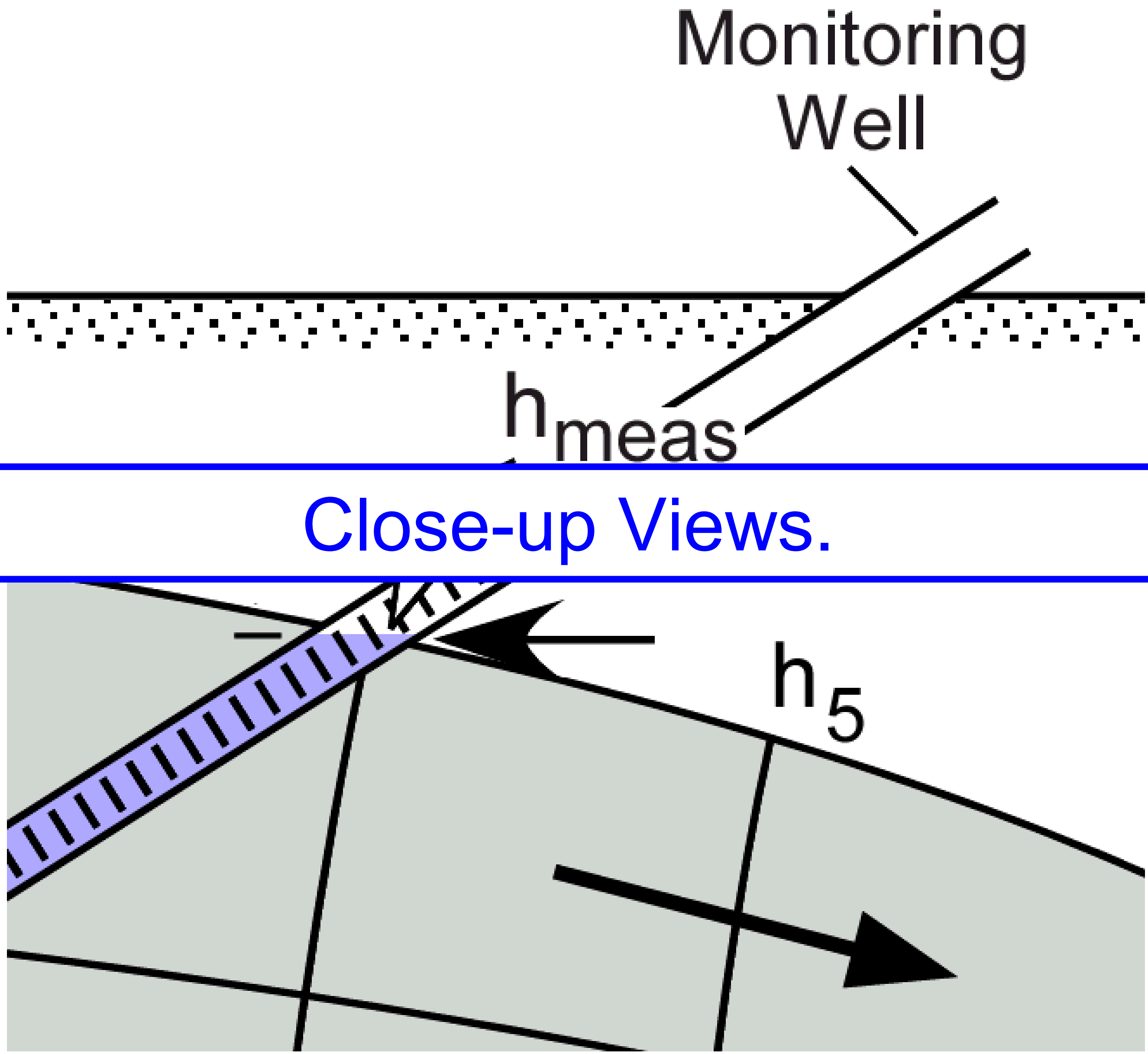
An interesting aside is the direction of flow <u>in the well</u>.

To what level does water rise in a slanted, continuously-cased well, open (screened) at the bottom?

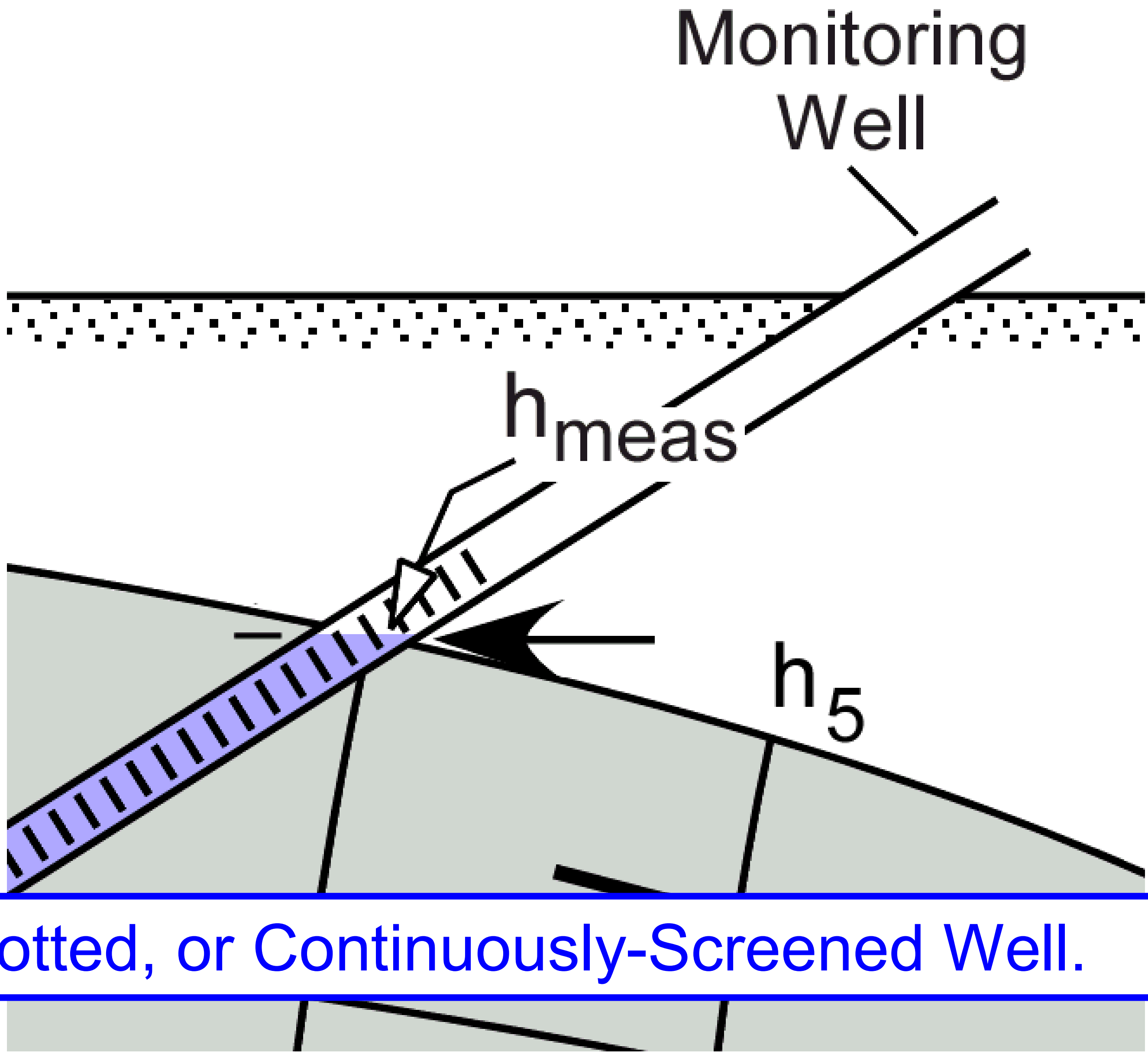


Questions – comments?

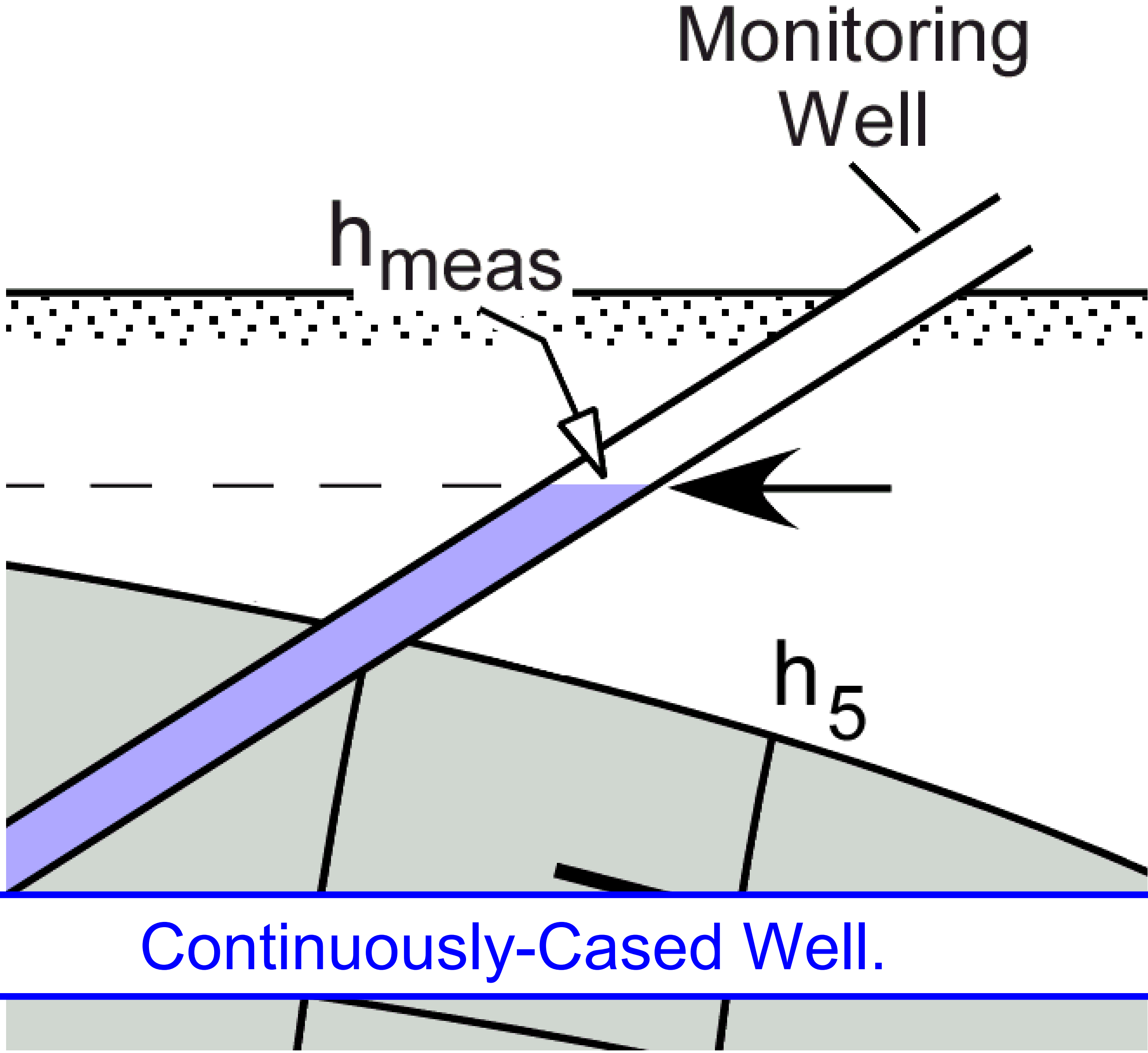




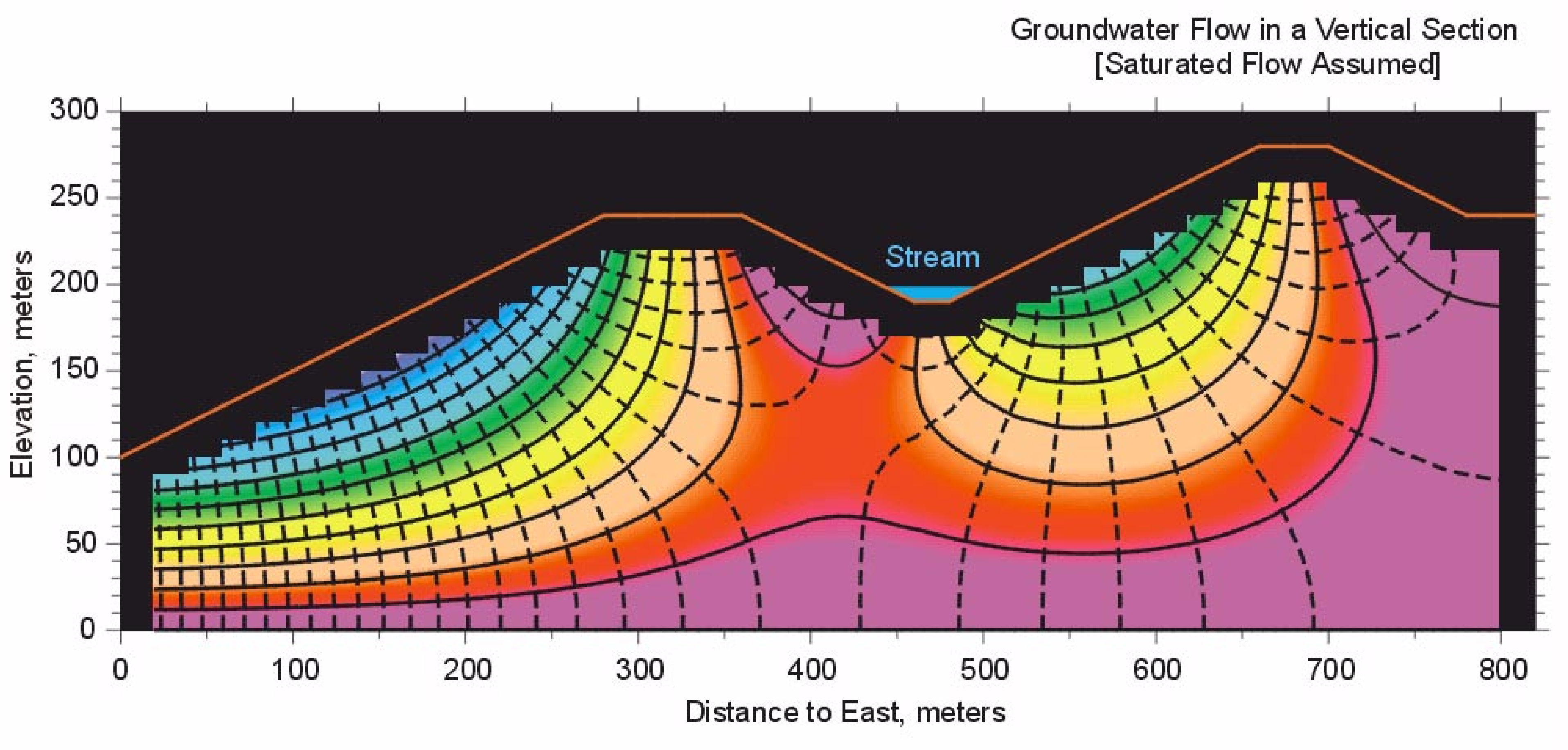
Close-up Views.



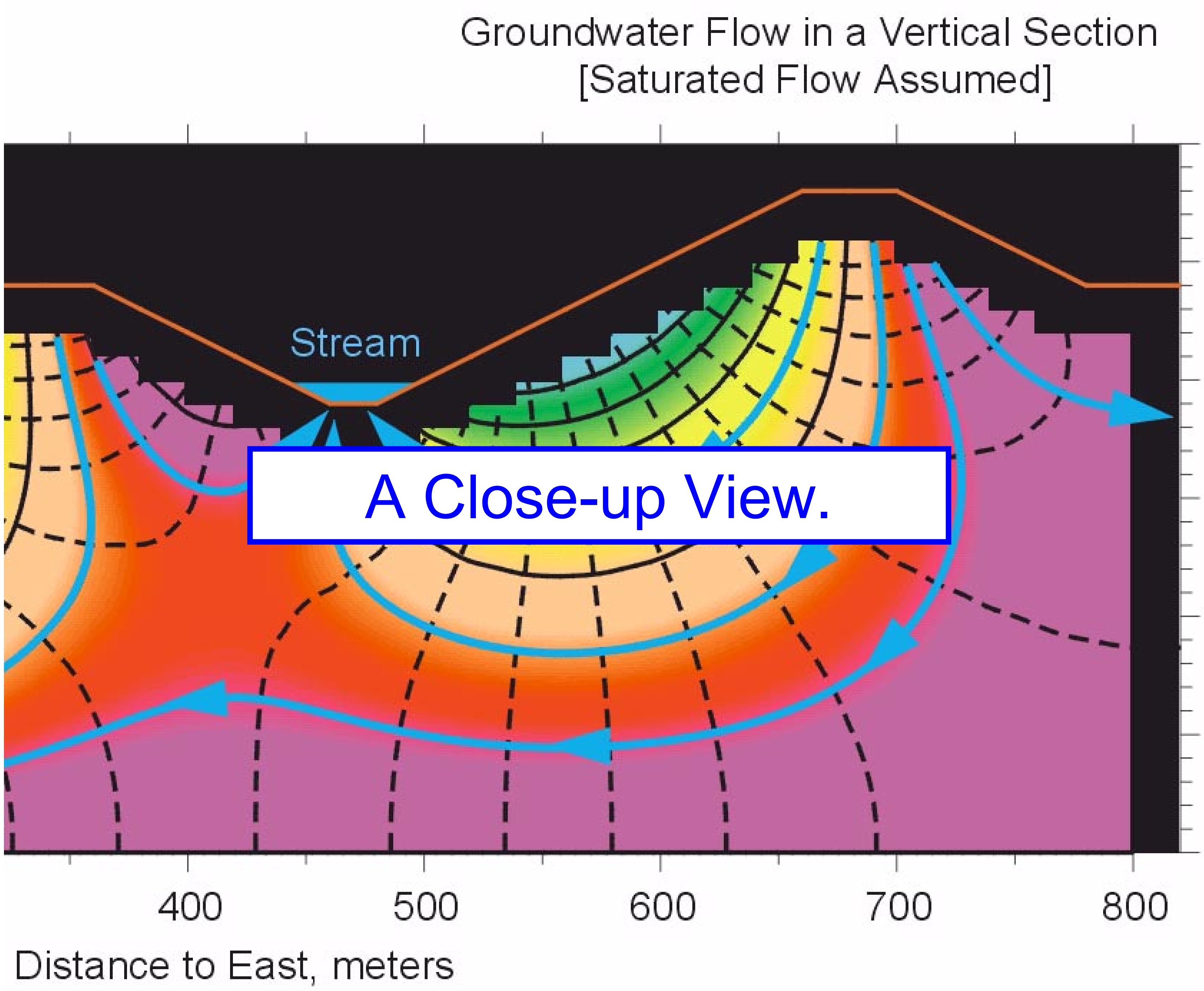
Slotted, or Continuously-Screened Well.

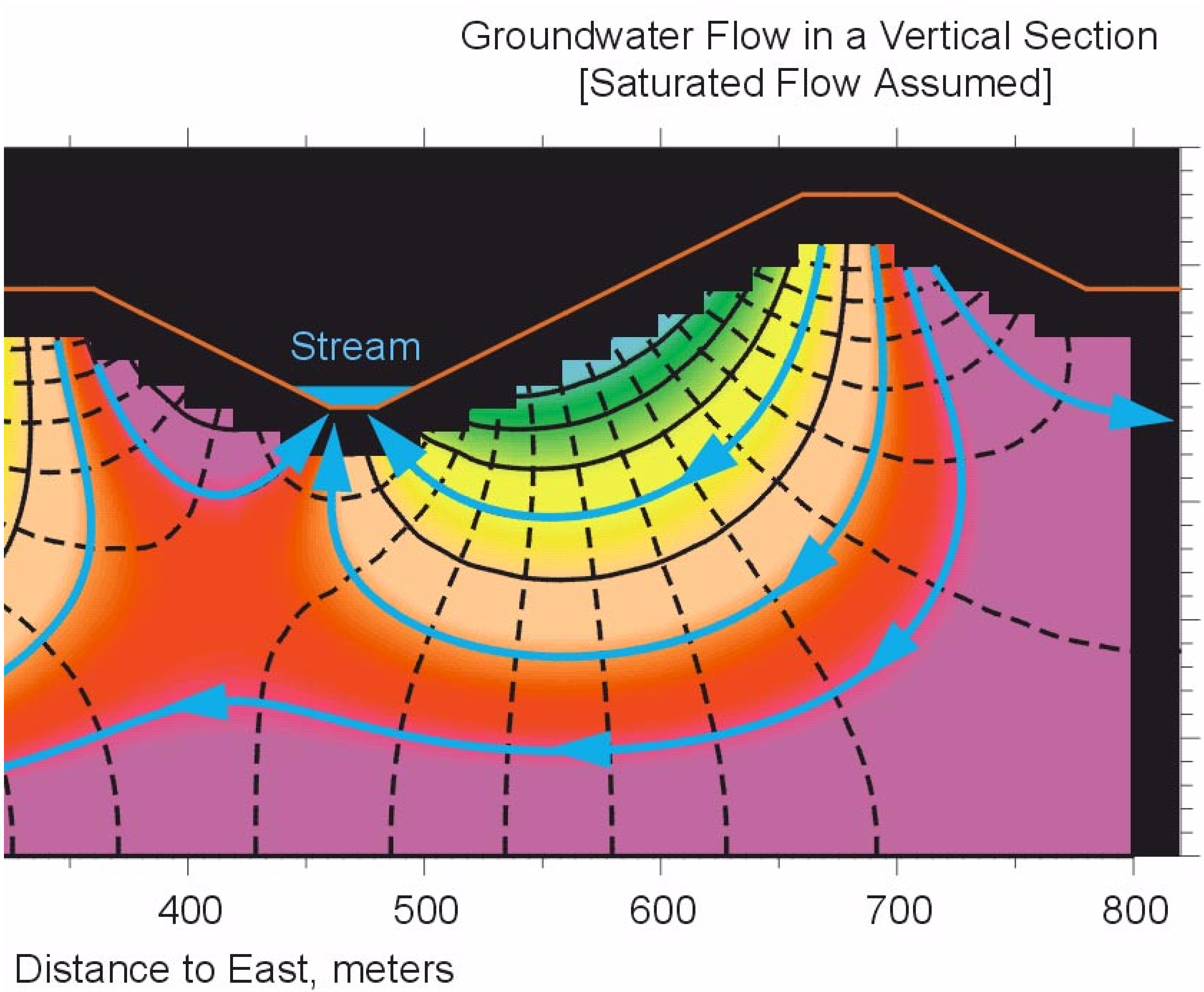


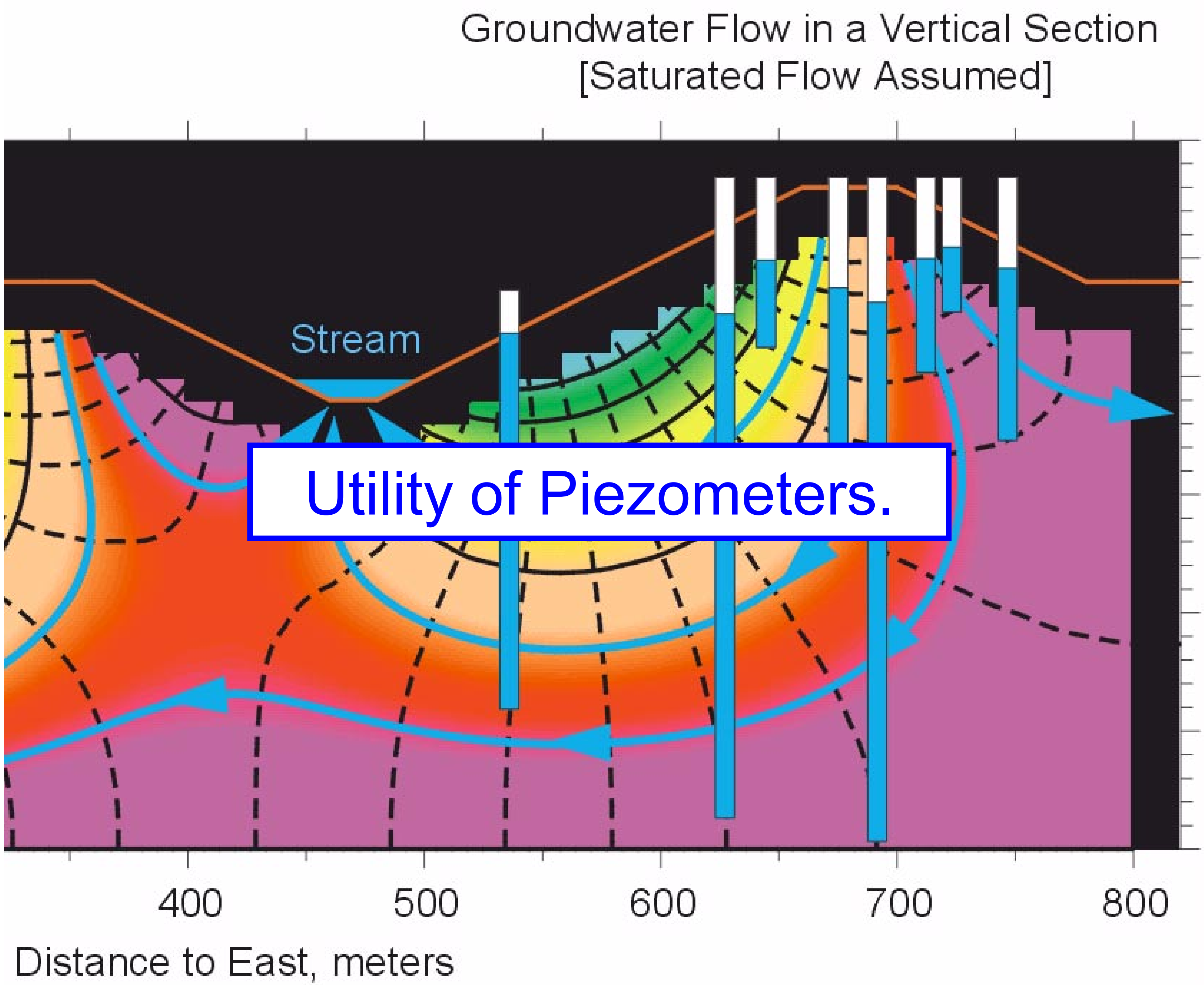
Continuously-Cased Well.



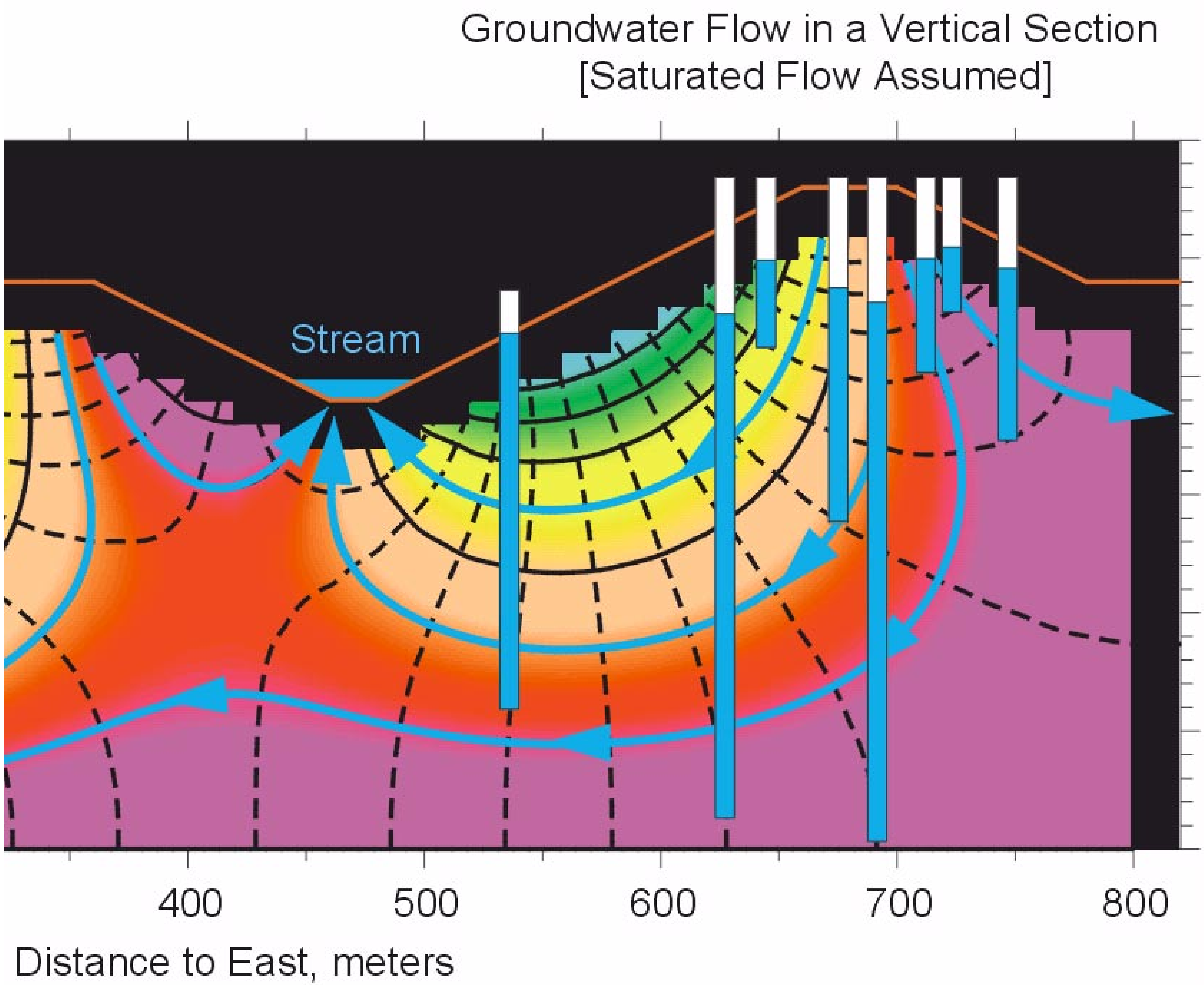
Let’s revisit our numerical model.


Groundwater Flow in a Vertical Section
[Saturated Flow Assumed]
Stream
A Close-up View.
400
500
600
700
800
Distance to East, meters

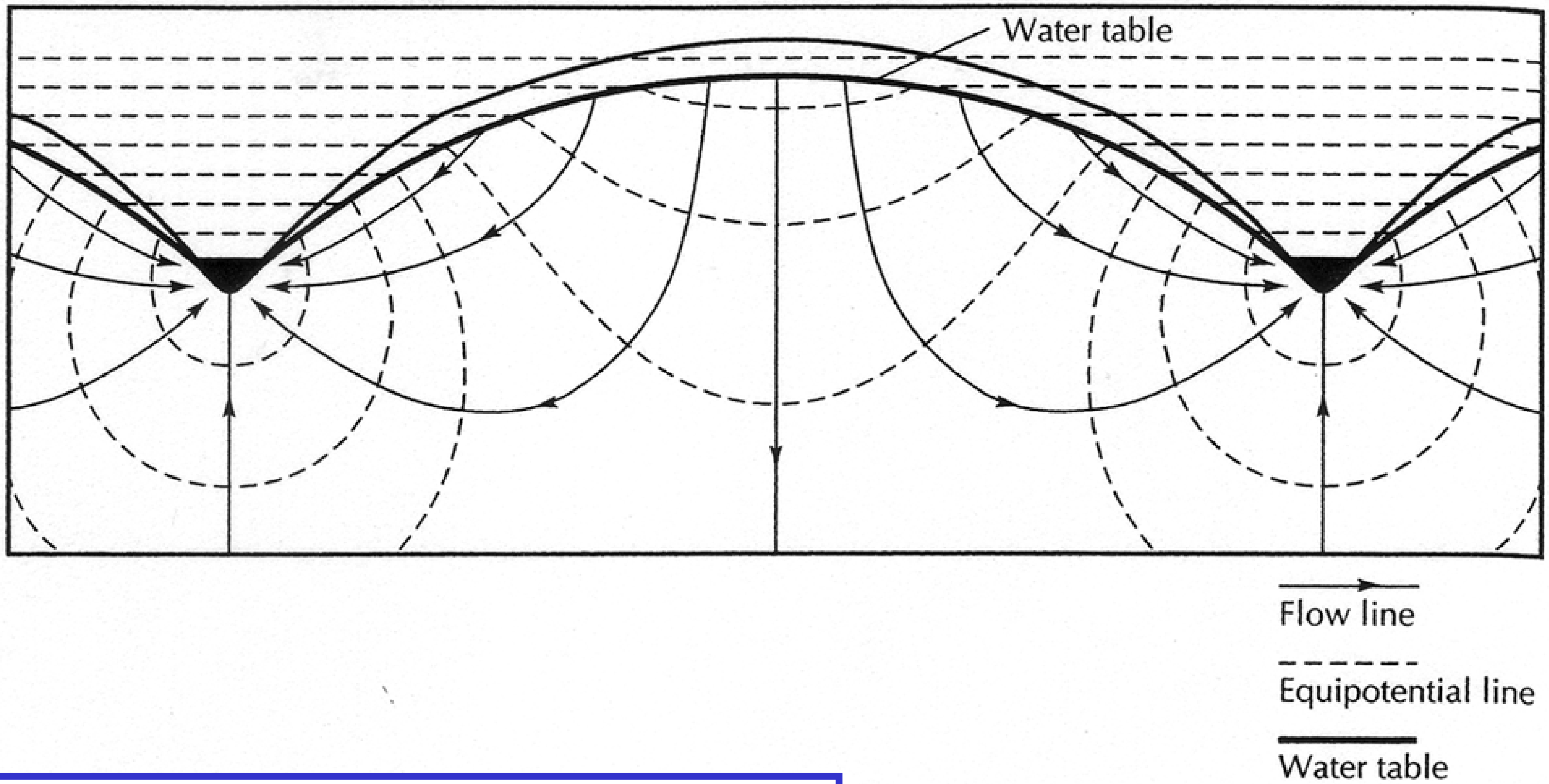

Groundwater Flow in a Vertical Section
[Saturated Flow Assumed]
Stream
400
500
600
700
800
Distance to East, meters



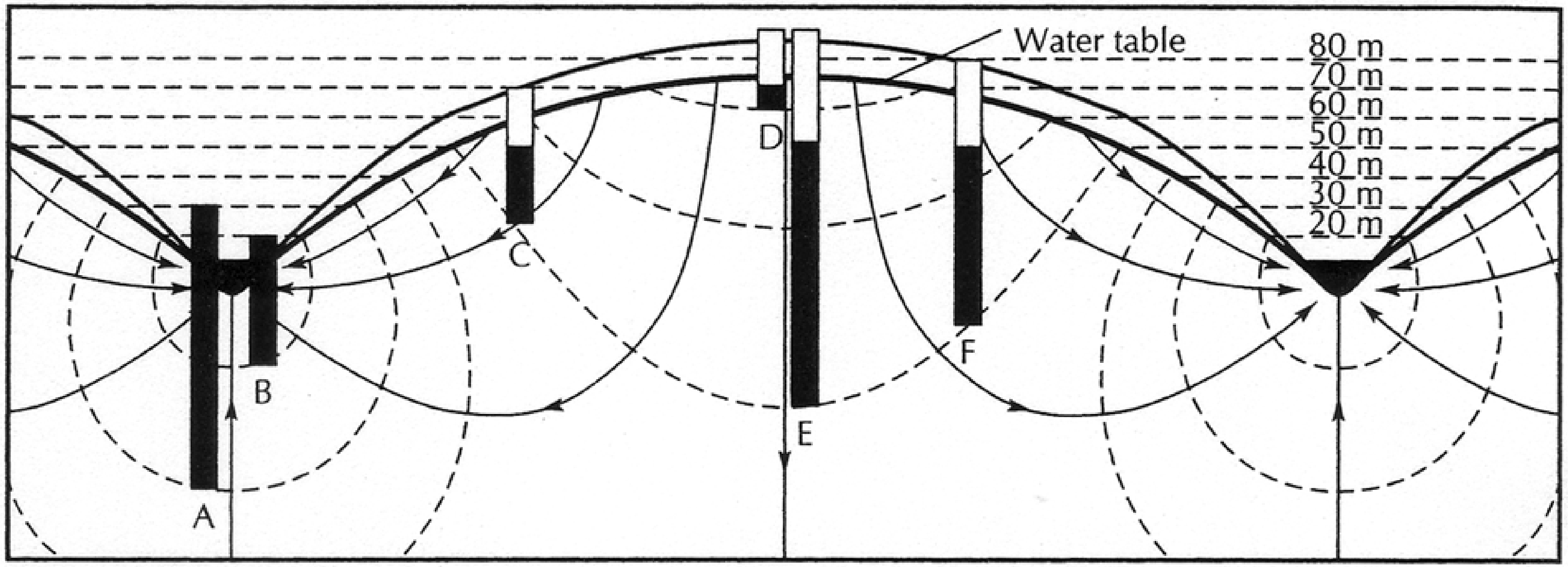
Utility of Piezometers.


Groundwater Flow in a Vertical Section
[Saturated Flow Assumed]
Stream
400
500
600
700
800
Distance to East, meters

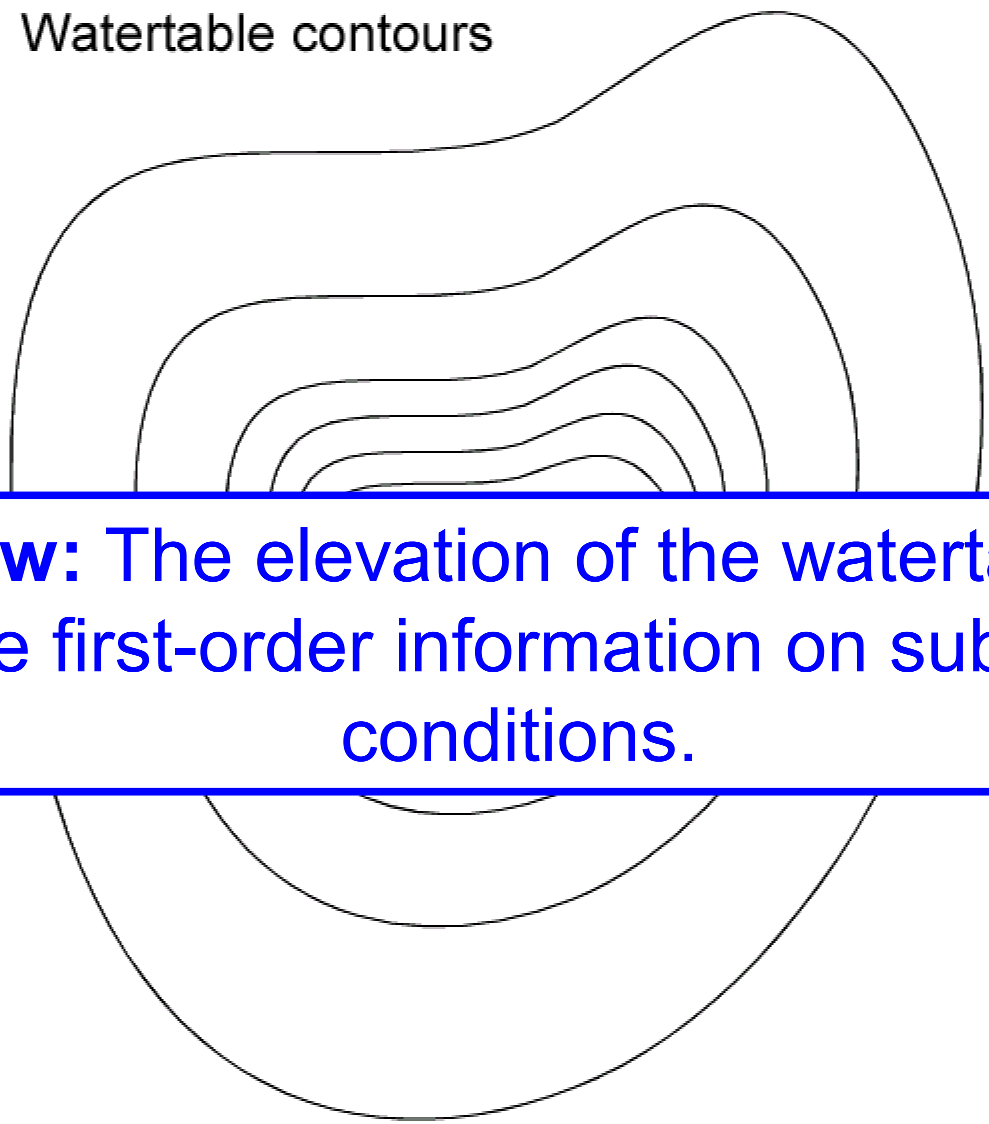
Regional Ground-Water Flow



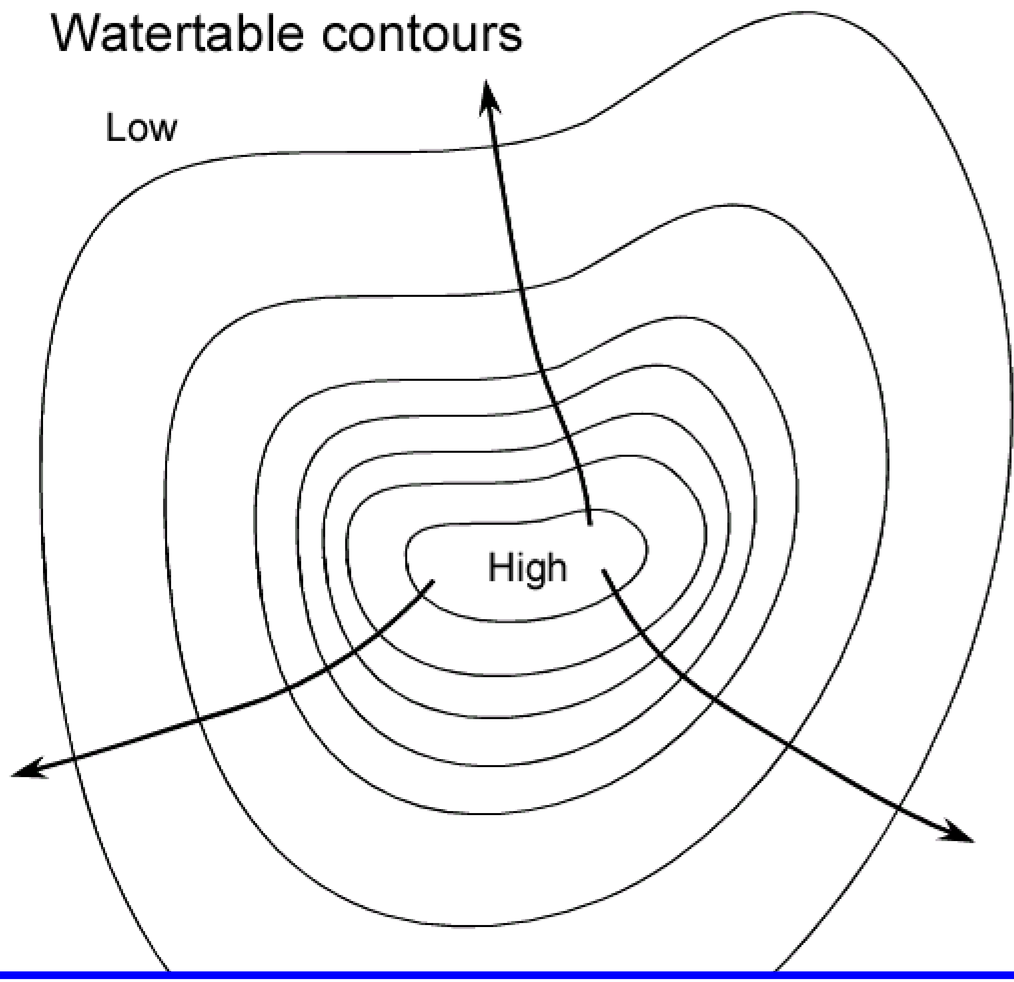
(*Source: Fig. 7.1; Fetter, 2001; after Hubbert, 1941.*)



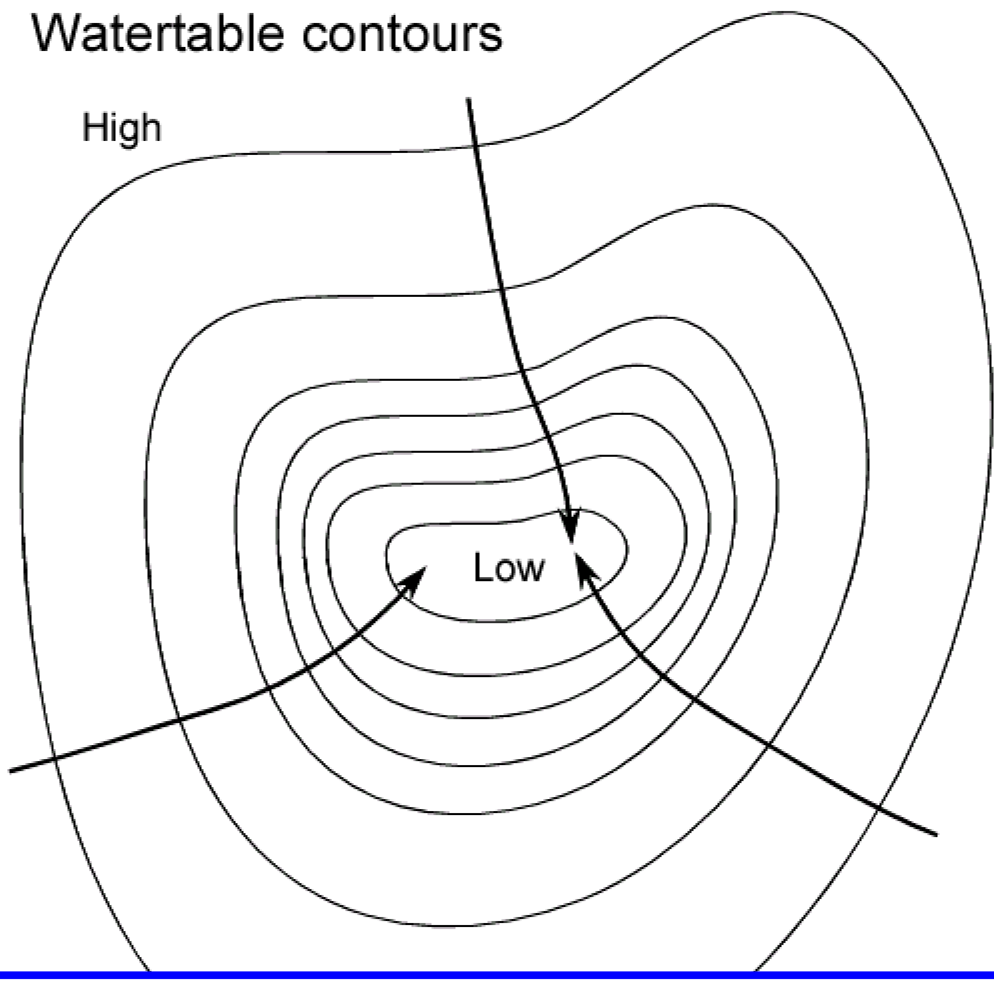
(*Source: Fig. 7.2; Fetter, 2001; mod'fd from Hubbert, 1941.*)



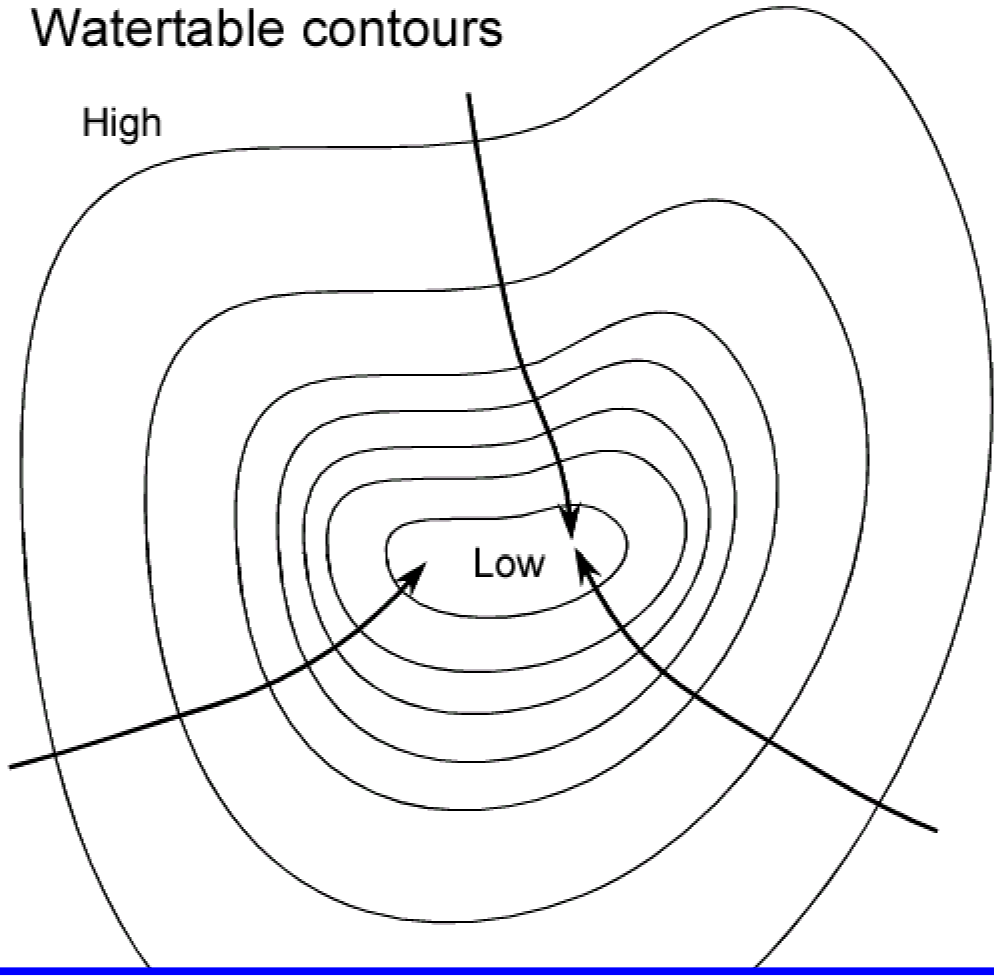
2D Flow: The elevation of the watertable can provide first-order information on subsurface conditions.



Flow from high elevations to low elevations.
Where’s the ***recharge*** area?

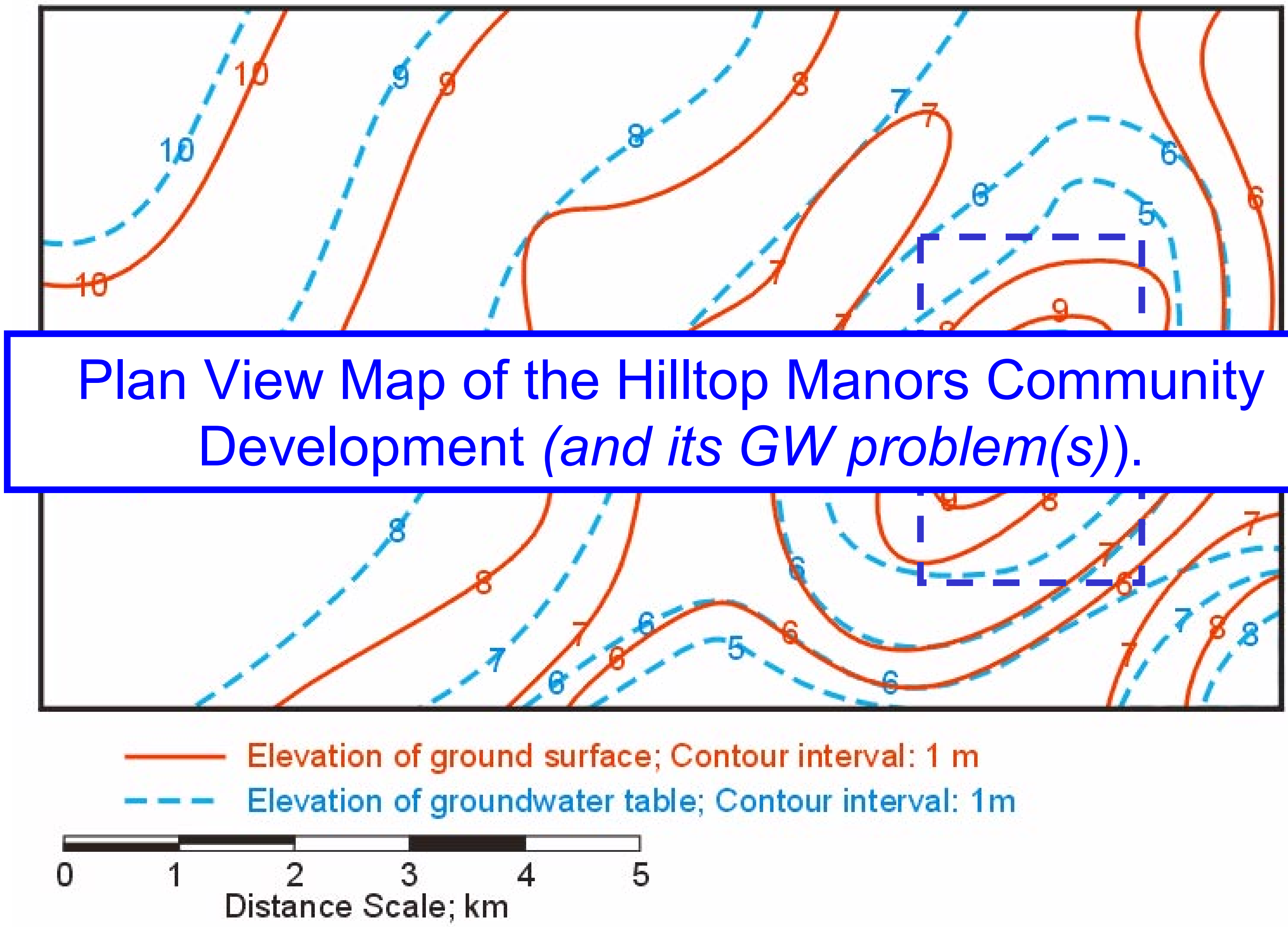


Flow from high elevations to low elevations.
Where's the ***discharge*** area?



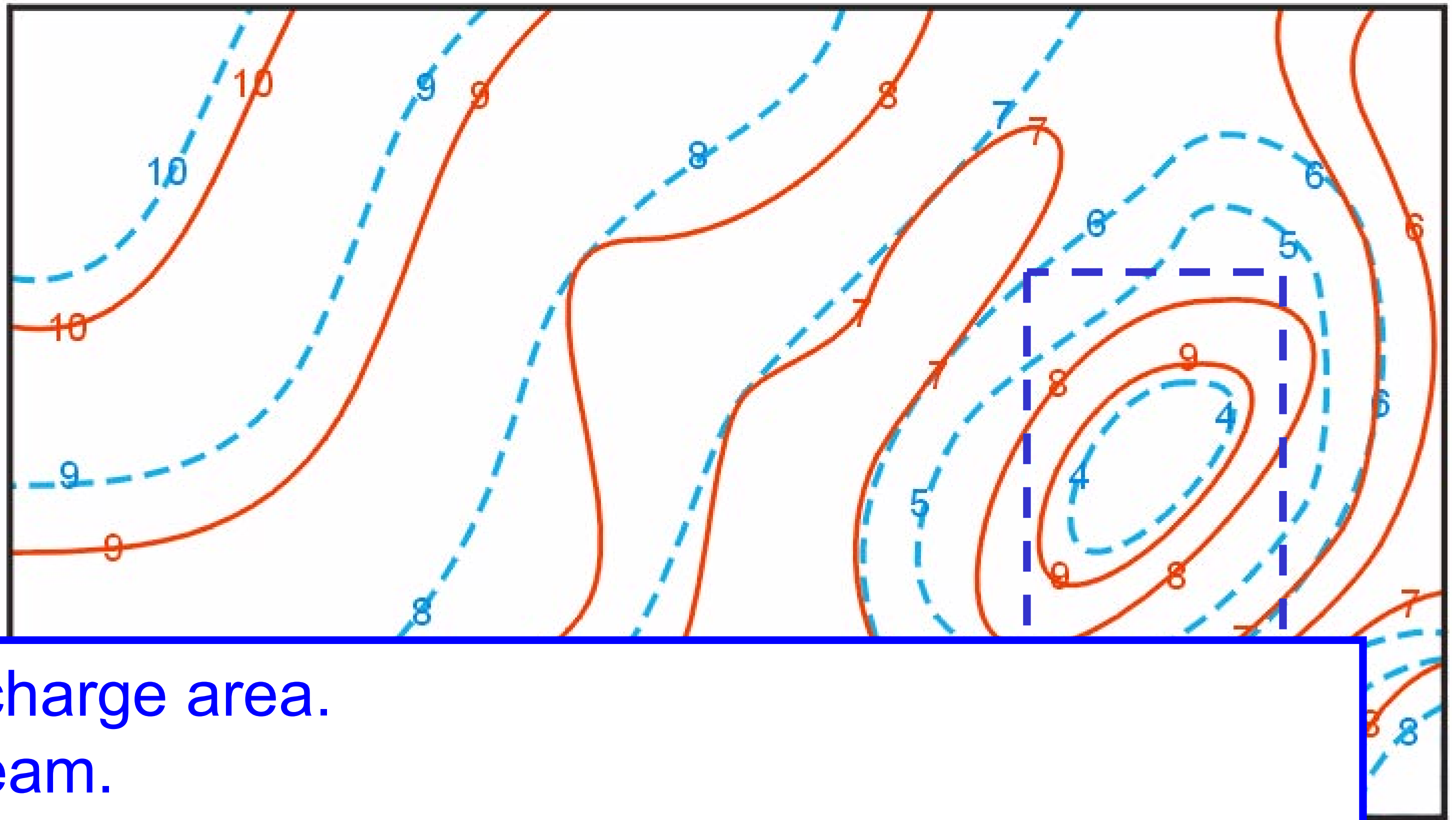
Note that these contours can simulate conditions in *either* the *horizontal* ***or*** the *vertical* plane.

Example of surface and groundwater contours.



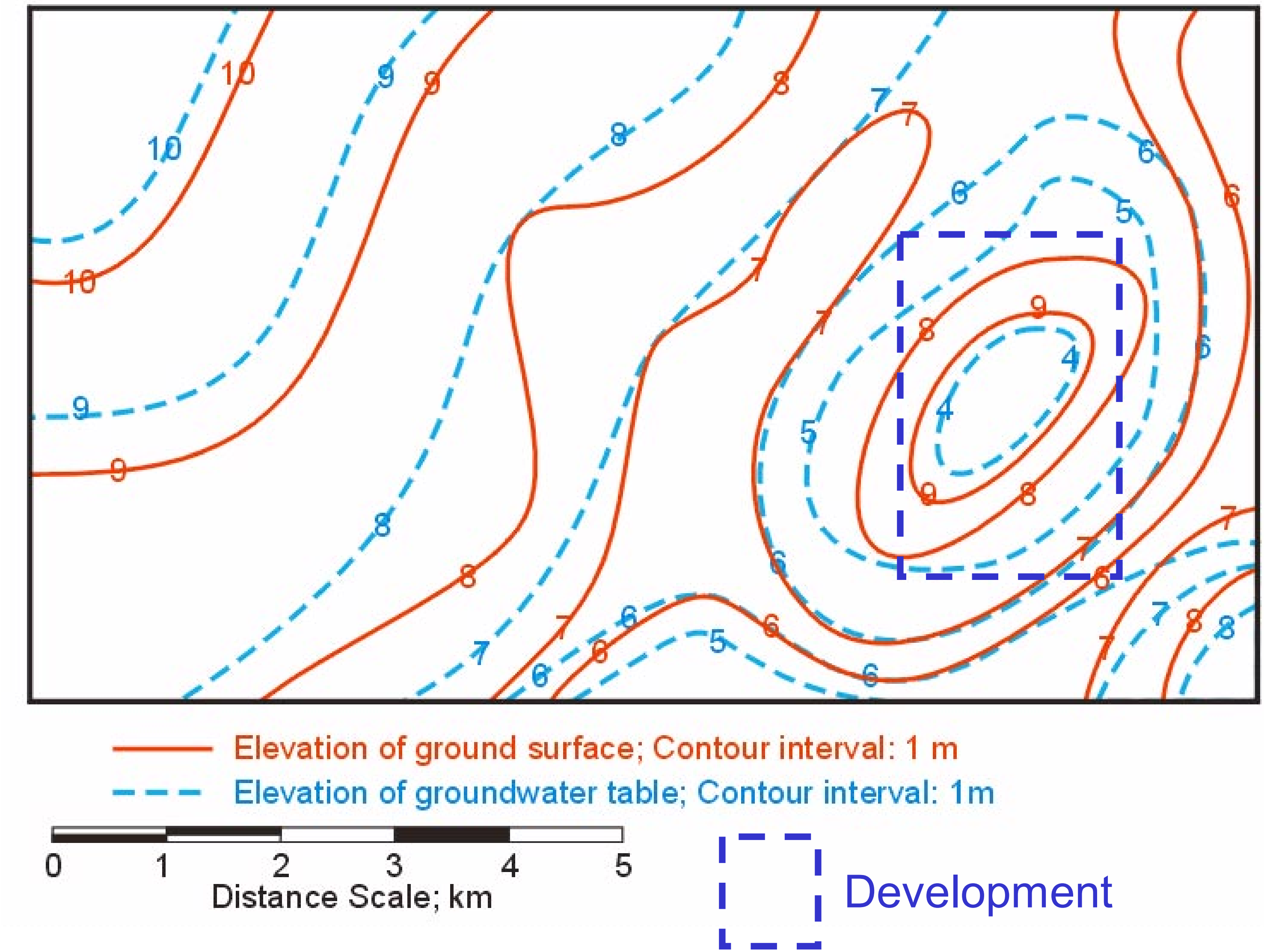
Plan View Map of the Hilltop Manors Community Development *(and its GW problem(s))*.

Example of surface and groundwater contours.

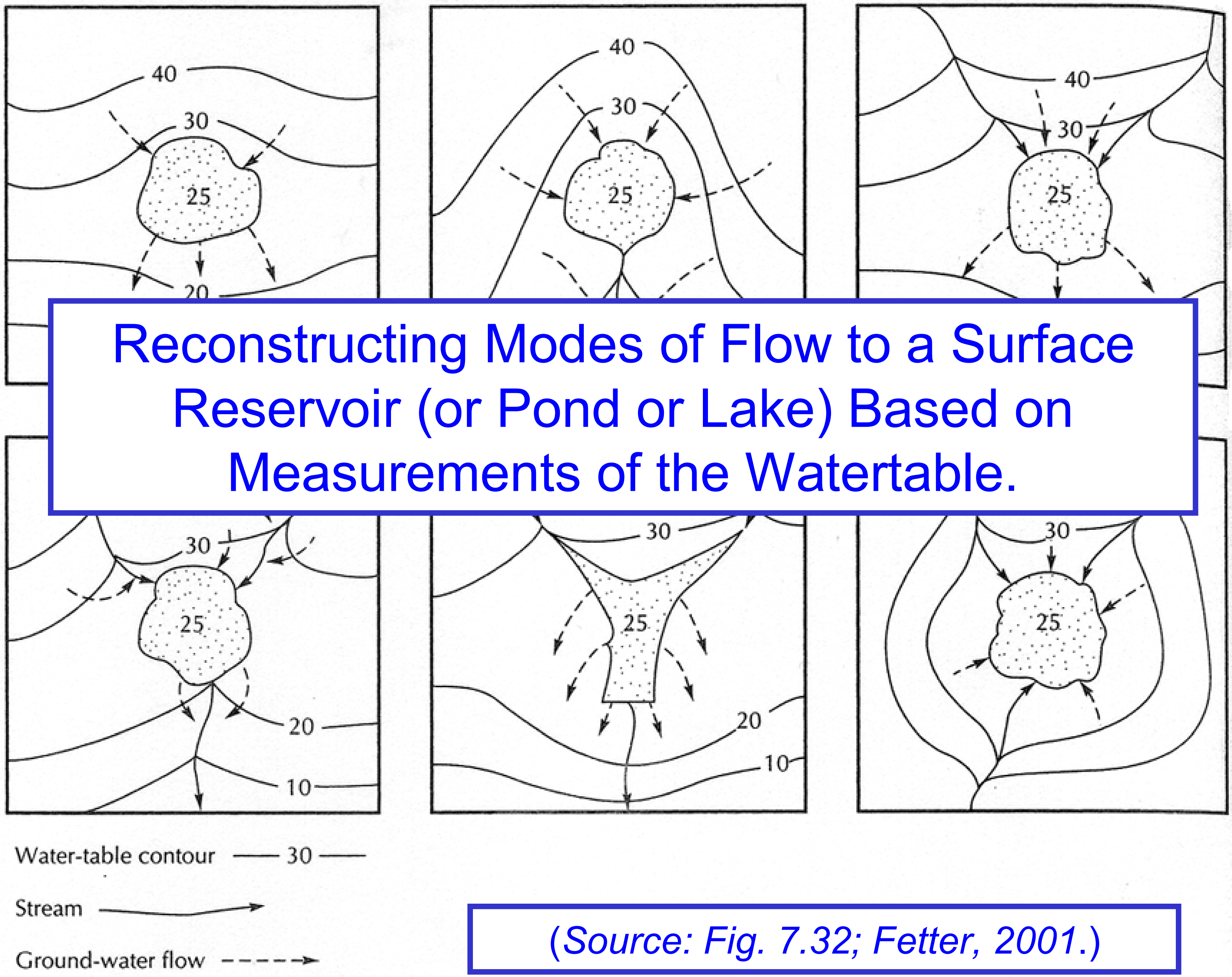


- Recharge area.
- Stream.
- Swampy area(s).
- Over-pumped (discharge) area.
- Stressed branch of stream & adjacent wetlands.

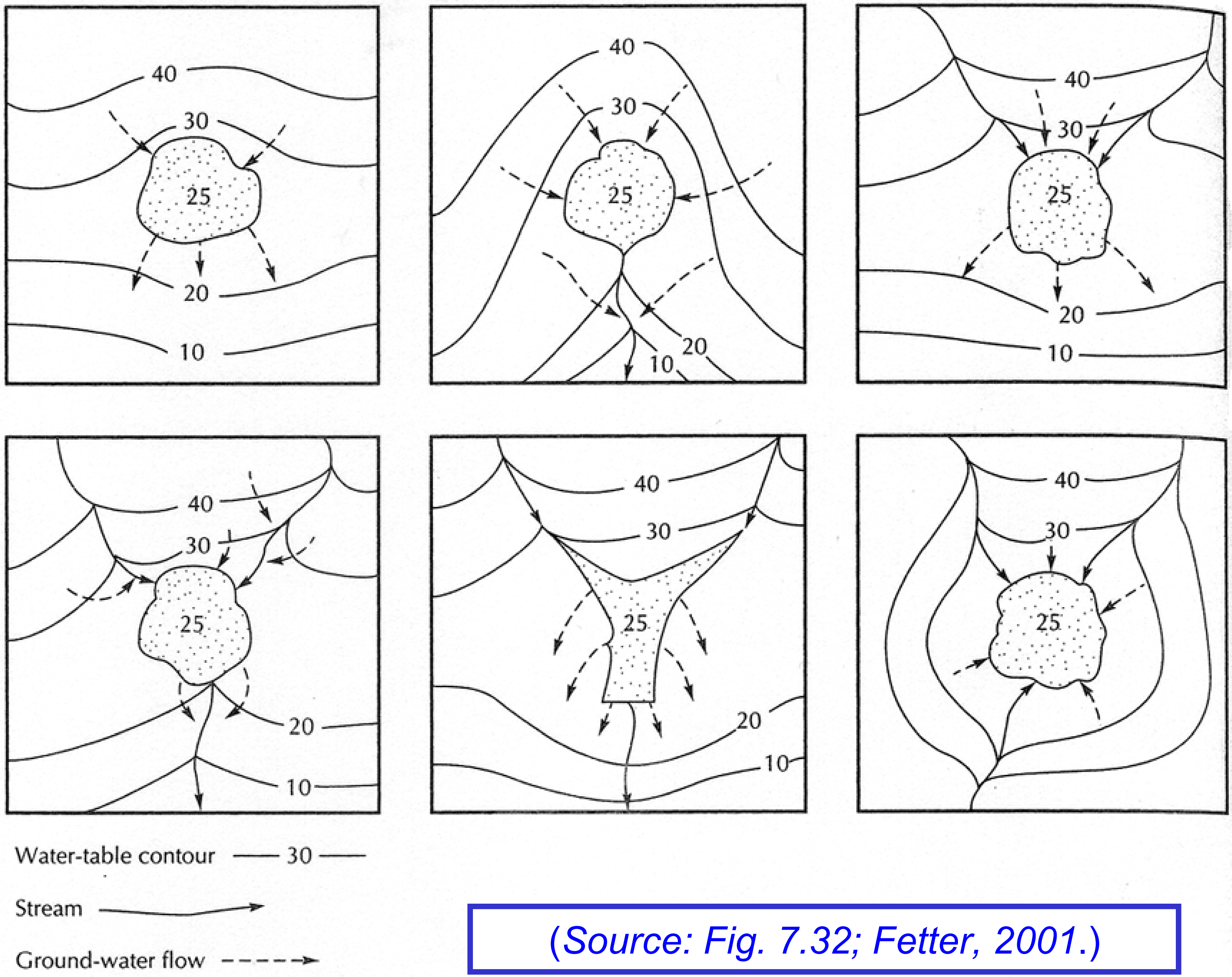
Example of surface and groundwater contours.



Reconstructing Modes of Flow to a Surface Reservoir (or Pond or Lake) Based on Measurements of the Watertable.



(*Source: Fig. 7.32; Fetter, 2001.*)



(*Source: Fig. 7.32; Fetter, 2001.*)