What to Know About Groundwater Flow Interactions with White Lake

Based on the work of Consolvo (2022), Shank and Zamora (2019), and Frey (1949)

o   Sources of water supplying White Lake: rainfall and groundwater from the surficial or water table aquifer, which surrounds and underlies the lake. There is no evidence for any deeper confined aquifer contribution to the lake.

o   The higher the water table level is above the lake level, the greater the hydraulic gradient—the driving force to move groundwater into the lake. Water table elevations rise because of *rainfall* (and fall when there is a lack of it).
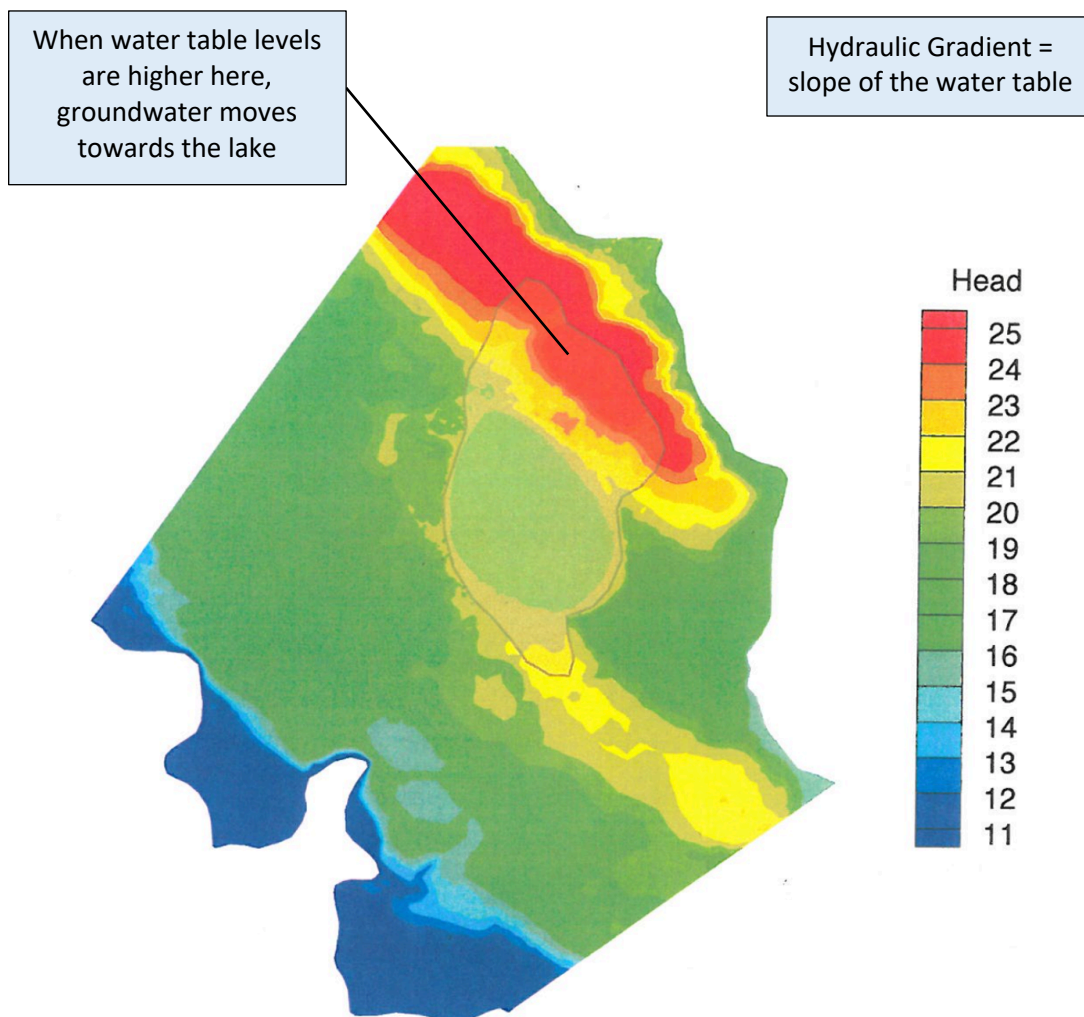
When water table levels are higher here, groundwater moves towards the lake

Hydraulic Gradient = slope of the water table

Head

25
24
23
22
21
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12
11

Figure provided by Shank and Zamora in a 2018 quarterly report to the Town of White Lake.

o Groundwater flow interactions with White Lake are *variable*, depending on the dynamics between *lake levels* and *water table levels*.
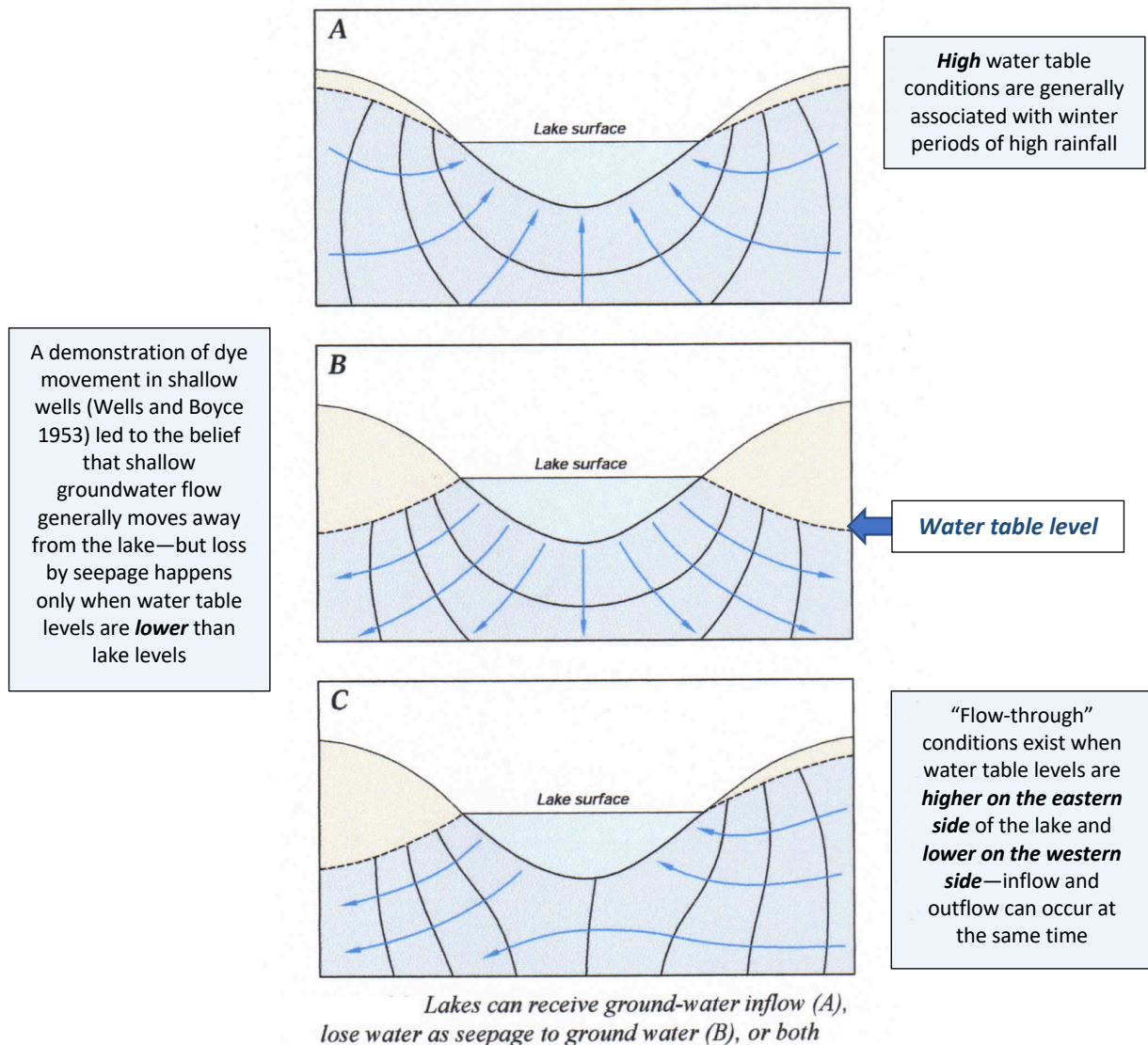

A

Lake surface

High water table conditions are generally associated with winter periods of high rainfall

A demonstration of dye movement in shallow wells (Wells and Boyce 1953) led to the belief that shallow groundwater flow generally moves away from the lake—but loss by seepage happens only when water table levels are *lower* than lake levels

B

Lake surface

Water table level

C

Lake surface

"Flow-through" conditions exist when water table levels are *higher on the eastern side* of the lake and *lower on the western side*—inflow and outflow can occur at the same time

Lakes can receive ground-water inflow (A), lose water as seepage to ground water (B), or both

Flow From Springs Related to Water Table Levels

o   David Frey studied Bladen County Bay Lakes in the 1940s and noted that small springs were found in shallow water in all these lakes.

o   White Lake's distinctive springs have been described as depressions up to 8 inches deep, with "dimples" visible in these sandy areas.

o   The surficial aquifer is bisected by a clay "hardpan" layer in many areas, creating a semi-confined aquifer below the clay. The White Lake springs are places where there is no hardpan clay layer, so when the water table levels are sufficiently higher than lake levels, flow from the deeper surficial aquifer can be visible as "boils" of water stir up the sand.

o   Often, flow from the springs sites is not visible or detectable by temperature differences, but seepage is sufficient to keep the sandy depressions clear of sediment buildup, so that they have been visible in aerial photos.

Screenshot of 2013 aerial photo of White Lake (accessed from Bladen GIS website), showing the springs, which cluster around the 7-foot contour on the eastern shoreline. Rainfall in June and July of 2013 was very high.