Introduction and Overview of Wetbud

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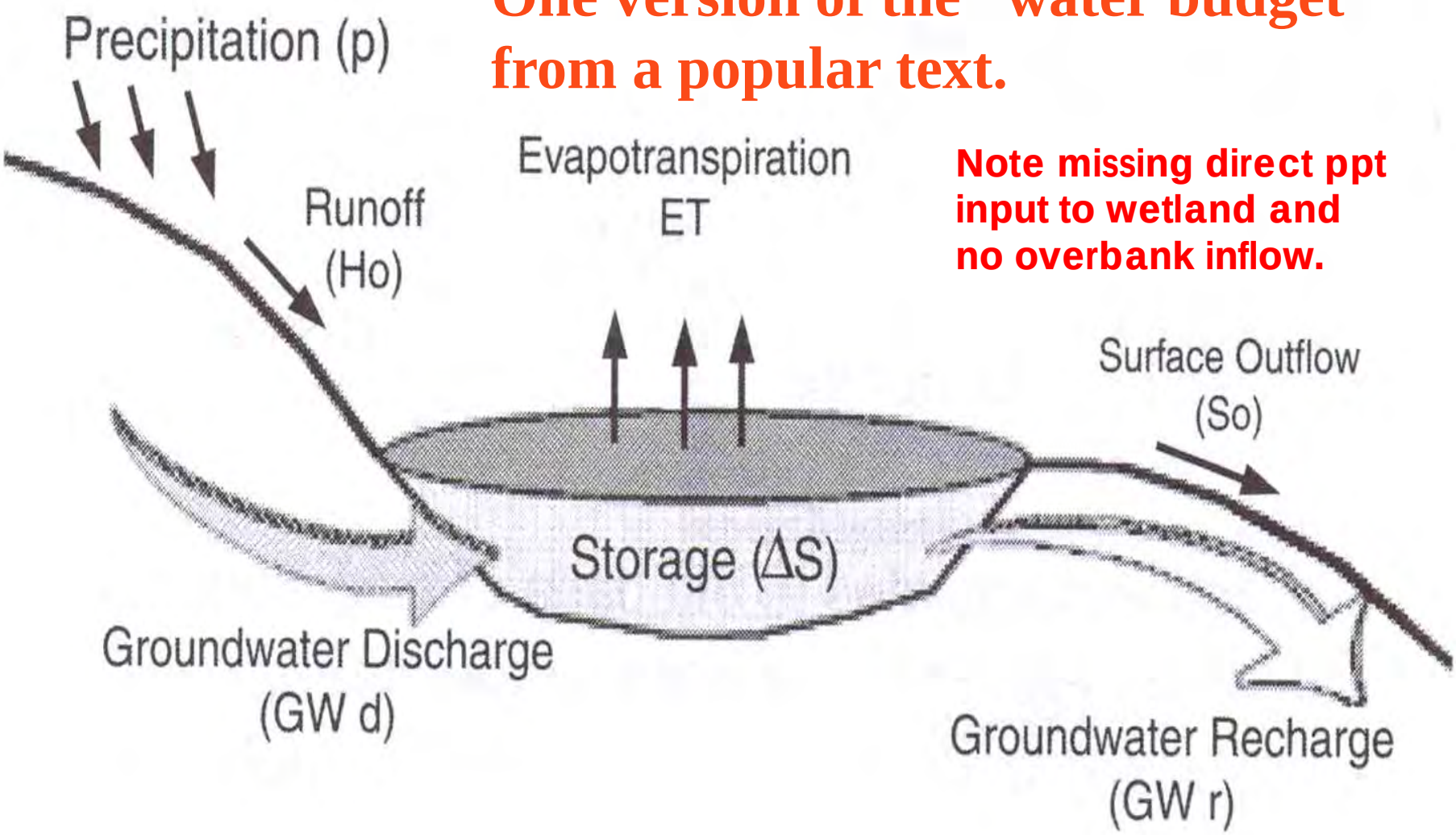
INPUTS = OUTPUTS + / - STORAGE

$$P + Ho + GWd = Gwr + So + ET + \Delta Storage$$

One version of the "water budget" from a popular text.



Note missing direct ppt input to wetland and no overbank inflow.

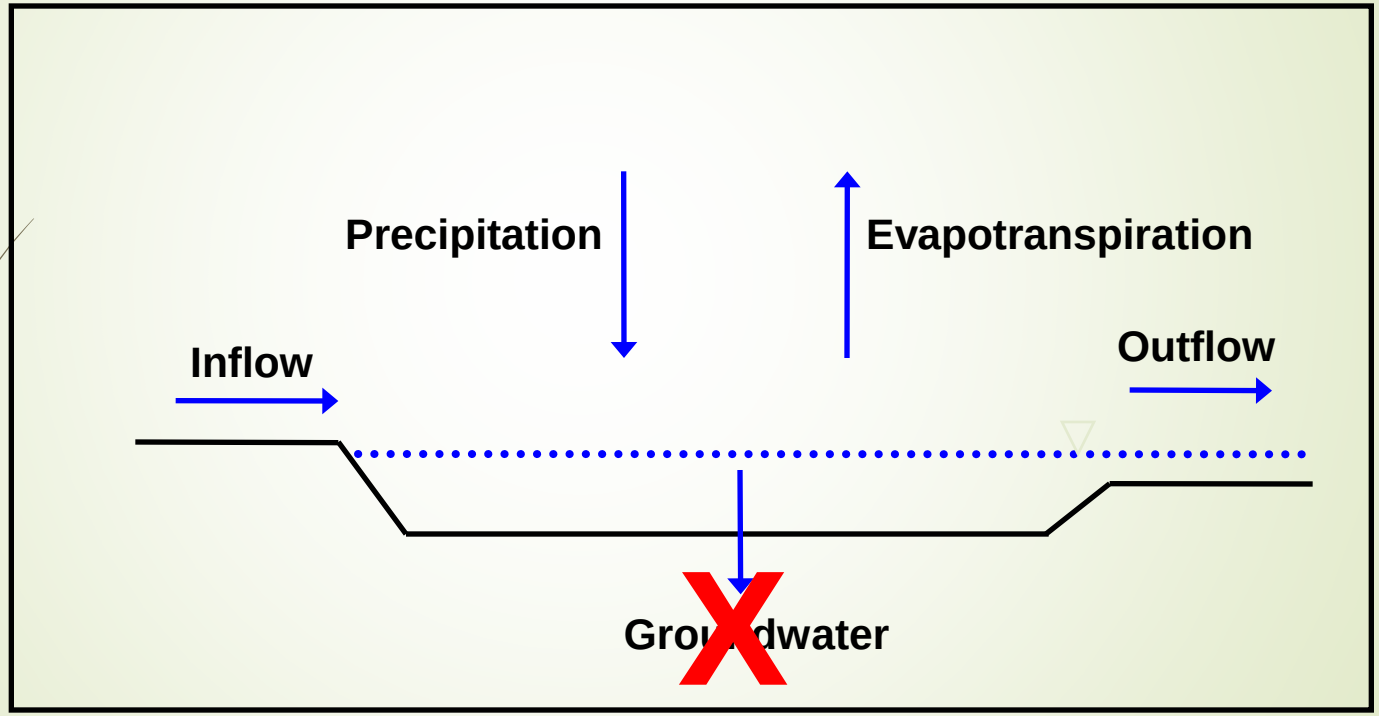
Created Wetland Water Budgeting

- **Wide variation in water budgeting approaches among agencies and consultants.**

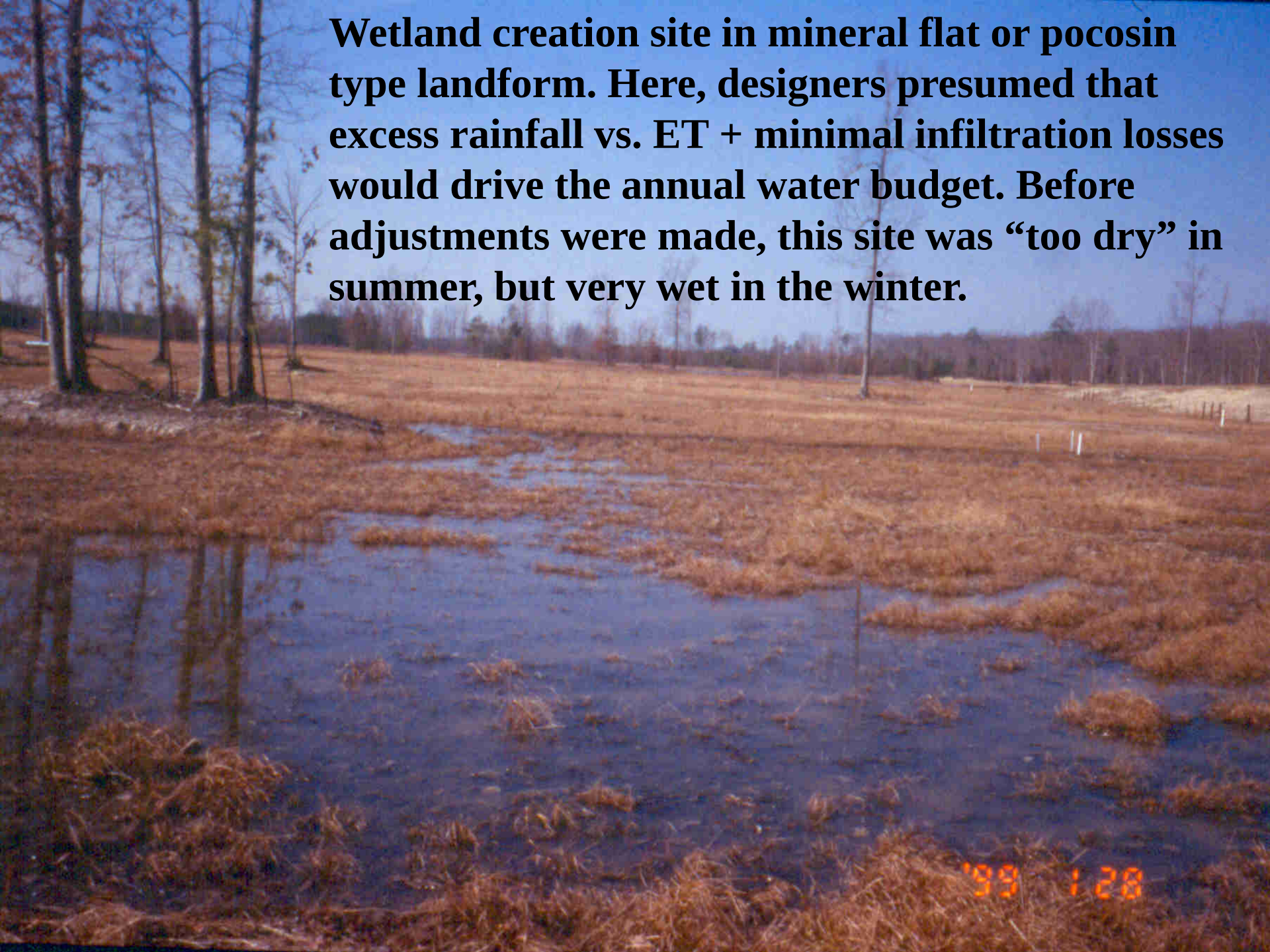
- **Many agencies follow and/or recommend variations of the "Pierce Approach" whereby ground water flux is presumed minimal, ET is estimated via Thornthwaite, runoff additions are estimated via SCS/NRCS Runoff Curve Number Method, water is presumed to be detained over the site via a berm, and water level is controlled via an outlet, etc.**

A “simple” way to create a mitigation wetland is to create a perched system

Can work on hilltops with low permeability compacted subsoils



assume negligible



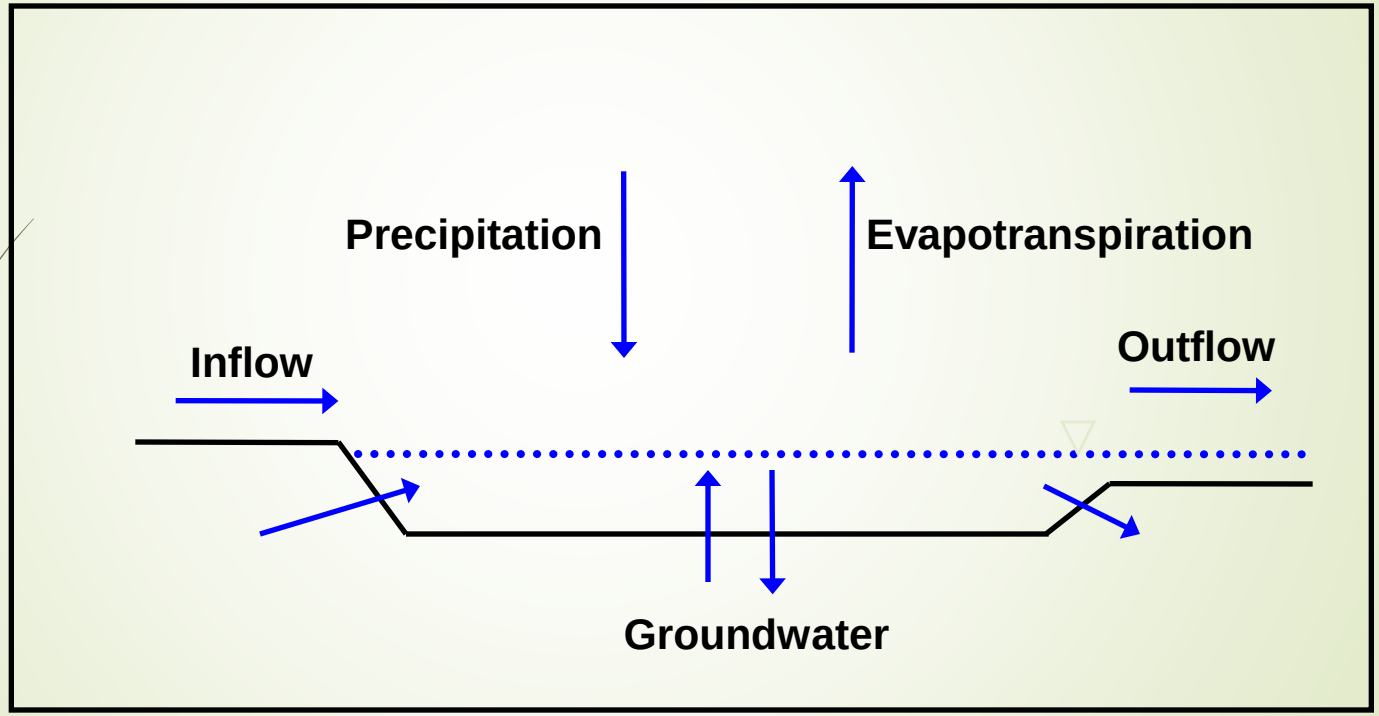
Wetland creation site in mineral flat or pocosin type landform. Here, designers presumed that excess rainfall vs. ET + minimal infiltration losses would drive the annual water budget. Before adjustments were made, this site was “too dry” in summer, but very wet in the winter.

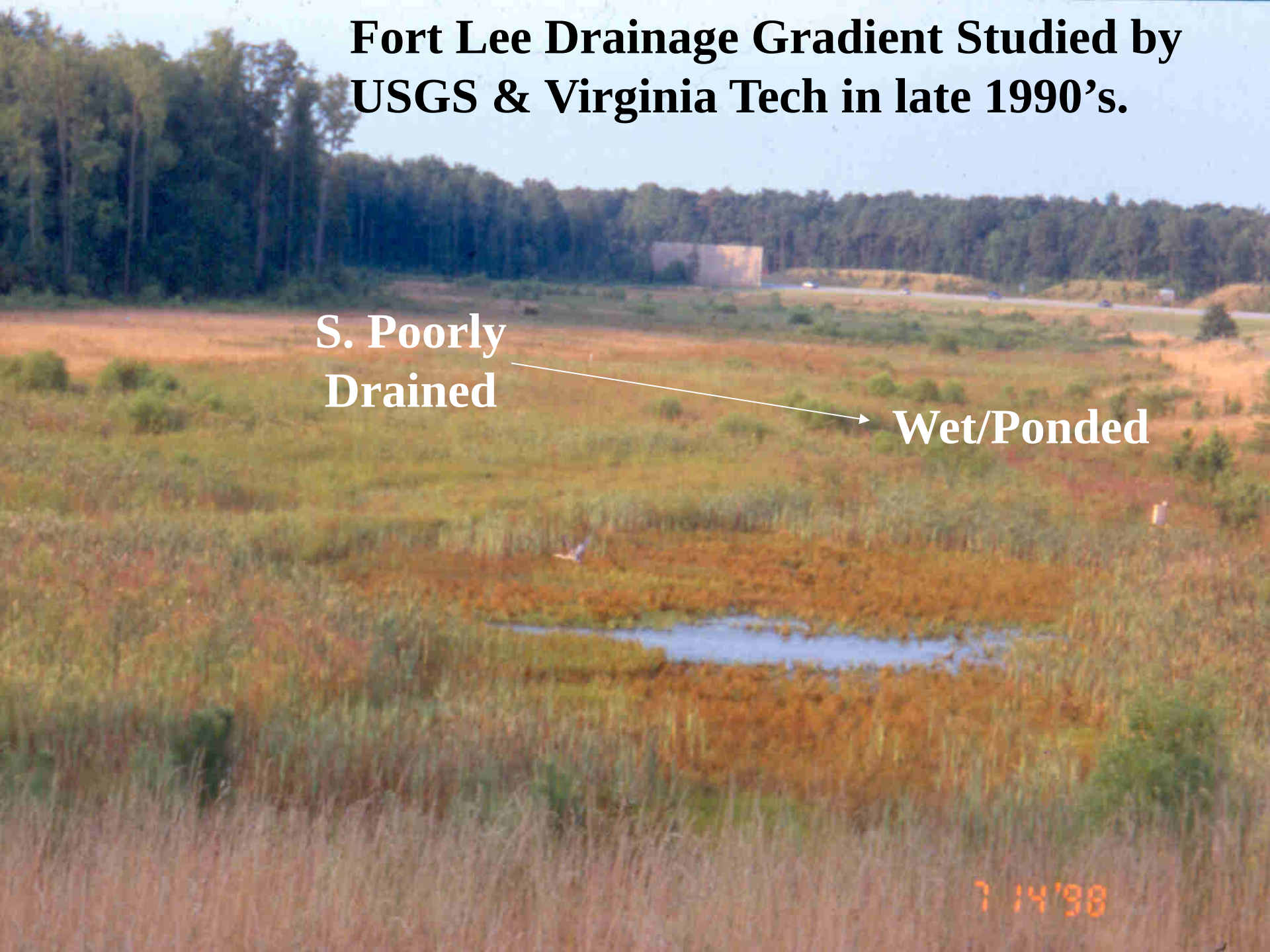
Surface soil from an anonymous 3-year old mitigation wetland.

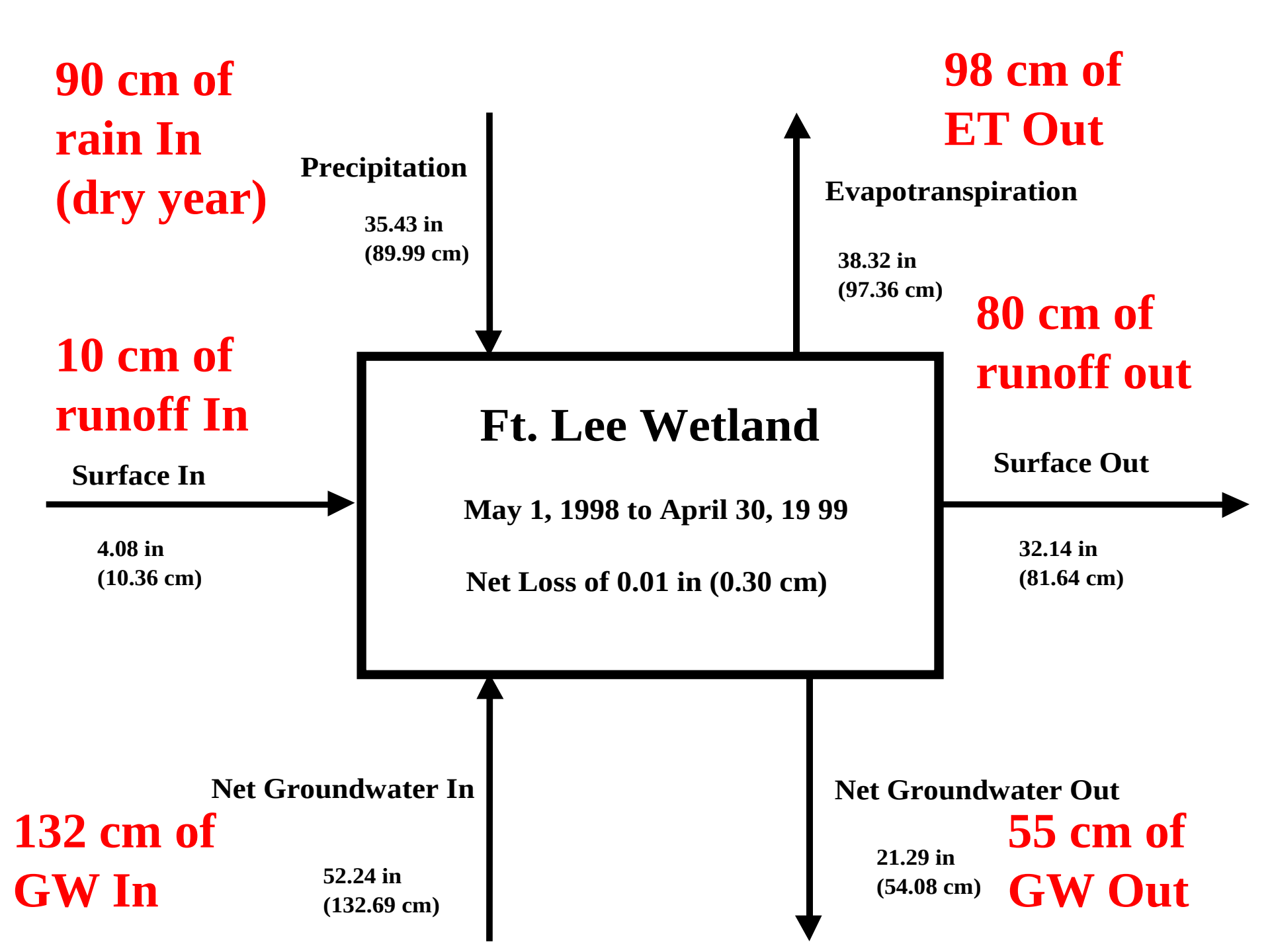
Note massive structure in surface breaking to firm plates at about 20 cm. This is the “traffic pan” that was designed to perch the water table, but also led to extremely dry summer conditions.

In most wetlands, groundwater can seep IN and OUT many places

Ignore GW? The wetland can be “too wet”




Fort Lee Drainage Gradient Studied by USGS & Virginia Tech in late 1990's.
S. Poorly Drained
Wet/Ponded
7 14'98


90 cm of rain In (dry year)
Precipitation
35.43 in (89.99 cm)
98 cm of ET Out
Evapotranspiration
38.32 in (97.36 cm)
80 cm of runoff out
10 cm of runoff In
Surface In
4.08 in (10.36 cm)
Ft. Lee Wetland
May 1, 1998 to April 30, 19 99
Net Loss of 0.01 in (0.30 cm)
Surface Out
32.14 in (81.64 cm)
Net Groundwater In
132 cm of GW In
52.24 in (132.69 cm)
Net Groundwater Out
21.29 in (54.08 cm)
55 cm of GW Out

Wetbud History

Program originally funded via RFP #2 (Wetland Water Budgeting) by WSSI & Peterson Family Foundation in 2008.
<u>Original objectives</u> and tasks:

Review literature, survey regulatory and industry practices, and document all known water budget methodologies;

Interview experienced wetland scientists and engineers about existing design and construction issues related to wetland water budgets;

Find existing constructed wetlands in the Virginia Piedmont with sufficient geologic data and hydrologic instrumentation from pre- and post-construction evaluations for model evaluation;

Develop a library of historic rainfall data for all NOAA stations in Virginia and classify each year as “dry,” “typical,” or “wet”;

Generate detailed tables with interpretative information of Piedmont soil conditions with respect to expected infiltration, permeability, and other important hydrologic and plant growth parameters;

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Original objectives and tasks:

Assess existing software and individual process-models (e.g. Darcy, Thornthwaite, etc.) for applicability to the Virginia Piedmont, ease-of-use, and accuracy;

Work with project collaborators to adapt existing software or to develop independent software modules and package for use in wetland hydrologic assessments;

Test the new model using data sets developed from selected test sites;

Develop an instruction manual to explain how to collect or determine groundwater data for use in this model; collect, test, or verify topsoil and subsoil data; and install and use the associated computer model; and,

Develop training materials for use in workshops designed to teach others how to use the new software package.

Wetbud History

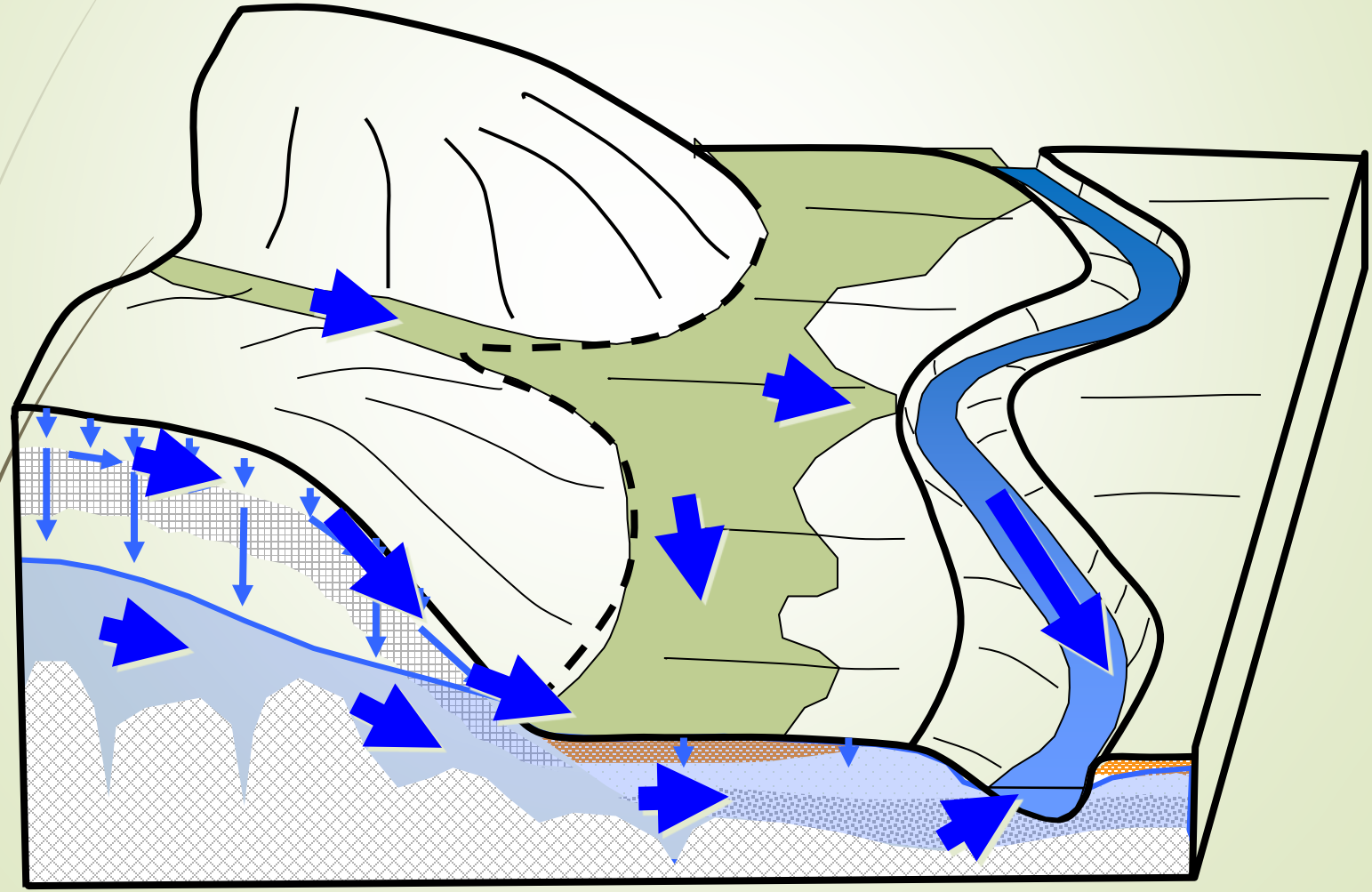
Program focused primarily on Piedmont (and Fall Zone) wetlands as research targets due to nature of funding.

Added support over time include more focus on MODFLOW, stream overbank (2011) and AET estimators (2013).

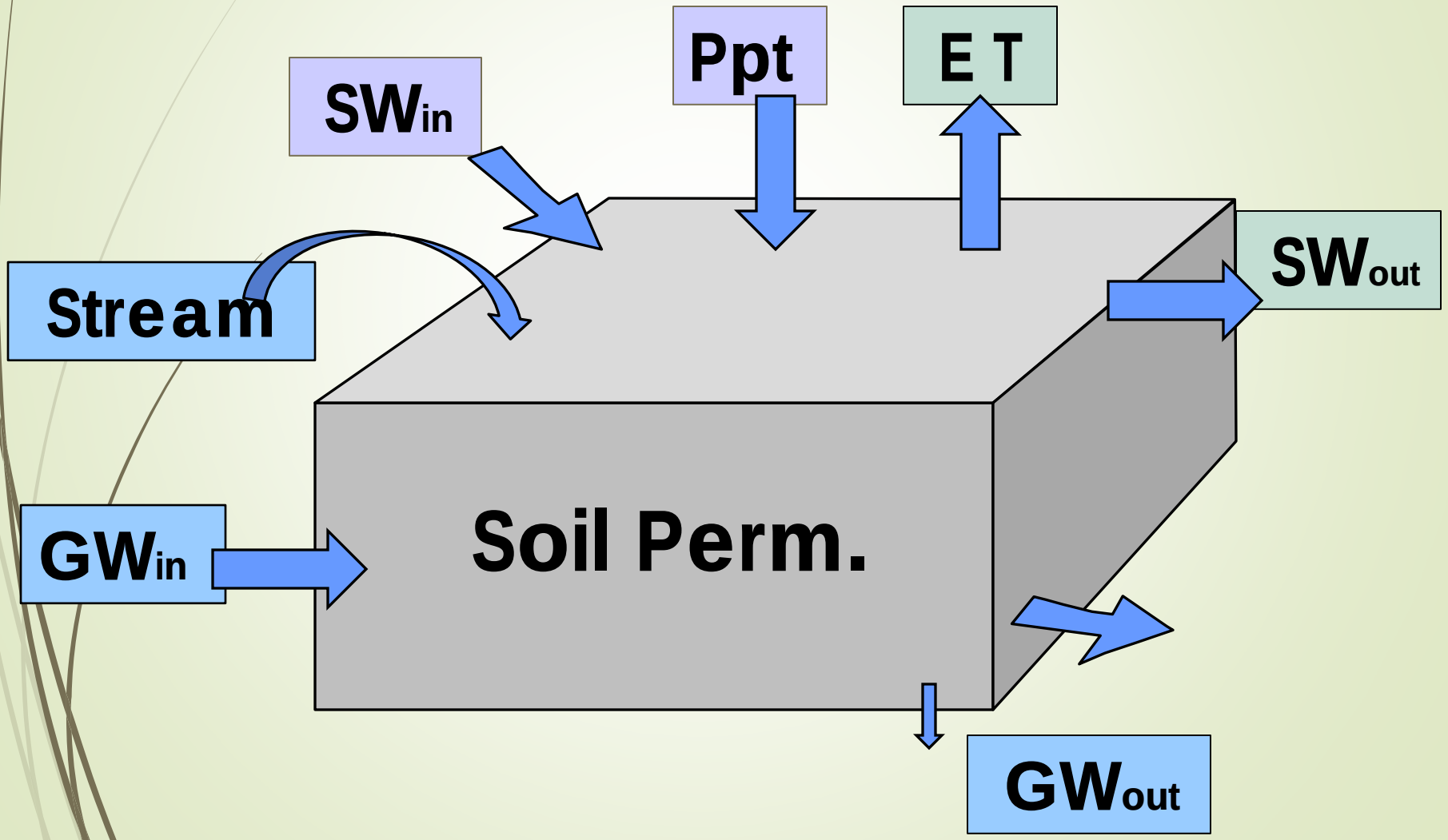
Continuing work at Huntley Meadows (FCPA) and at Julie Metz + North Fork (WSSI) sites to validate Wetbud components and compare ET estimators.

See www.huntleymeadows.org for more details on that site

Piedmont Wetlands:
the interface between uplands, groundwater, and surface water



Wetbud Basic Version

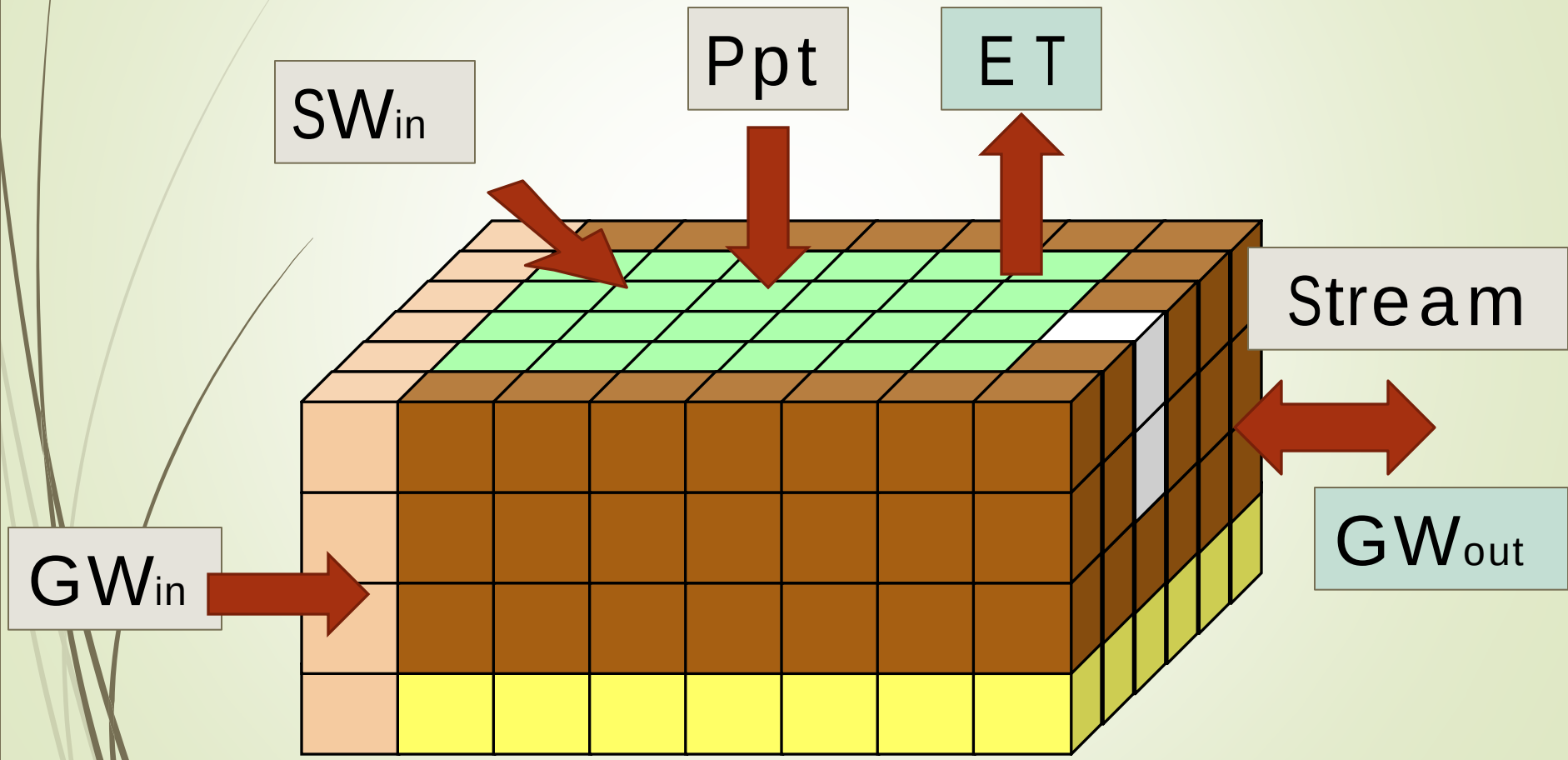


Wetbud Advanced Version

Allows for 3-D modeling including multiple soil/substrate layers, slopes, variable wetland topography, etc.

Incorporates more rigorous groundwater flux modeling via MODFLOW (basic model uses a simplified Darcy approach)

WetBud – Advanced Version



Who's doing what?

Zach Agioutantis, Univ. of Kentucky -- Programmer & MODFLOW

W. Lee Daniels, Virginia Tech -- Program coordinator & gadfly

Ben Hiza, Old Dominion University – Julie Metz models

Stephen Stone, Old Dominion University – Huntley Meadows models

Tess Thompson, Virginia Tech – Surface water

Rich Whittecar, Old Dominion University – Groundwater & MODFLOW

Previous Graduate Students: Kerby Dobbs, Matt Gloe, John McCleod, Eric Neuhaus, O. Waverly Parks, Candice Piercy, Tracy Thornton, Cal Smith

Research Associates/Specialists: Dan Evans, Katie Haering, Sara Klopf and Laura Lehman.