The Little Plover Basin model: Applying state-of-the-art simulation tools for groundwater management in Wisconsin’s Central Sand Plain

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The Wisconsin DNR has asked for an updated model to prototype groundwater management tools
Motivated by the increase in high-capacity wells and documented surface water impacts
Why the Little Plover River?

Abundant background information

Groundwater levels

Streamflow

Geology

Aquifer parameters

Recent low flows and river dry-up have raised concerns

Good scale for tool prototyping

Regulatory flow criteria exist

Photo credit: George Kraft
What’s new about this effort?

Wells, Recharge, and ET will be explicitly represented.

Groundwater Management Module for MODFLOW 2005

New stakeholder engagement ideas

Collect data → Construct model → Evaluate calibration → Compute Solution → Present Results to Stakeholders and the Public

Still image from the classic Little Plover River pump test: Watch it at http://fyi.uwex.edu/littleplovermodel/resources/
What’s new about this effort?

Solicit stakeholder input
Collect data
Evaluate calibration
Discuss correspondence to real-world conditions
Construct model
Compute Solution
Share intermediate results

Transparent building blocks

Present Final Results to Stakeholders and the Public

Model Process
Groundwater Management with MODFLOW

Constrained optimization.

Tradeoff water withdrawal with streamflow.

Tradeoff water withdrawal with water level.

Costs and benefits can also be included.
Groundwater Management with MODFLOW: sand box example—k field
Groundwater Management with MODFLOW: sand box example—base case
Groundwater Management with MODFLOW: sand box example—pump from below confining layer
Groundwater Management with MODFLOW: sand box example—pump from above confining layer
Groundwater Management with MODFLOW: constrain pumping to maintain heads

Extract 30 GPM

Extract 19 GPM

Head Constraints
The sand-and gravel aquifer and underlying sandstone aquifer
Preliminary simulated water-table contours

Zooming in on the Little Plover Basin
The model grid is uniform with 100-foot uniform spacing.
New Python scripts to (almost) automatically create a Streamflow Routing (SFR) package

Routing from the NHD Plus v.2 dataset

Elevations from contours in the National Map
Simulating Evapotranspiration associated with land use and irrigation practices
-15F January Evening in Plover
Many thanks to:
Wisconsin DNR
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UW—Madison
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Residents, growers, and environmental groups of the Central Sand Plain

Questions?

http://fyi.uwex.edu/littleplovermodel/