**Advanced Topics—Lake (LAK6) Package Problems**

**Lake Problem—1a**

We will be taking a version of the McDonald Valley problem that you previously calibrated and modify it to use the lake package to represent the lake instead of the constant head stress package. The lake package solves for lake stage and lakebed leakage separately from the groundwater flow continuity equation solved by the GWF model.

1. Copy the files in advanced\_topics/lake/lake0 directory to the empty advanced\_topics/lake/lake1a directory.
2. Run the existing model prior to making any changes. We have added observations to the Constant-Head (CHD6) stress package (chd.obs) which will create a comma-spaced-values file (chd.csv) with the net flow for all constant-head cells.
3. We will inactivate the groundwater model in layer 1 in the lake by defining a 0 IDOMAIN value in lake cells. Modify the IDOMAIN values for layer 1 to use the array defined in the ‘lake\_idomain.ref’ file. Change CONSTANT 1 for layer 1 to OPEN/CLOSE lake\_domain.ref.
4. Modify at.nam to use the Lake (LAK6) package and the provided lake file (at.lak) instead of the CHD6 stress package. The LAK6 package is using the observation package (lak.obs) to save the lake stage and net flow between the lake package and the GWF model during the simulation to a comma-spaced-values file (lak.csv).

Exercise 1:

Compare the net flow between the lake and the GWF model when the lake is represented using the CHD6 and LAK6 packages using the observation output. Explain any differences in the net flow between the simulations run using the CHD6 and LAK6 packages.

**Lake Problem—1b**

By using the lake package in problem 1a we found that lake stages decreased as a result of groundwater withdrawals. In this problem we will modify the problem to a transient problem to determine how long it takes for the lake achieve steady-conditions in response to groundwater withdrawals.

1. Copy the files from lake problem 1a to the empty advanced\_topics/lake/lake1b directory.
2. Modify the TDIS6 package to increase PERLEN for stress periods 2 and 3 (start with 10 years for both). Use a NSTP and TSMULT value of 10 and 1.5 for stress periods 2 and 3.
3. Create a Storage (STO6) package for the model. Make every layer convertible and use a constant specific storage and specific yield of 1x10-4 day-1 and 0.1, respectively. Stress period 1 should be steady-state and stress periods 2 and 3 should be transient. Use the STO6 Example Input File in the MODFLOW 6 – Description of Input and Output (p. 48) document as a template.
4. Add the storage package to the GWF model name file (at.nam).

Exercise 1:

Adjust PERLEN for stress periods 2 and 3 to determine how many years it takes to achieve steady conditions at the end of each transient stress period. The lake stage should match to two decimal places to the stage at the end of stress period 2 (8.90 feet) and 3 (9.33 feet).

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| Stress period | Time to steady conditions (years) |
| 1 |  |
| 2 |  |