Remember write reports as if a hydrologist that doesn’t know about your site or MODFLOW is the reader. **BTW** if I get a paper with a cut and paste of MODFLOW output I will return it without grading --- and there will be NO "CHANCES" VIA Re-submission. If you cut and paste MODFLOW output in a report the grade will be ZERO

**WOULD YOU LIKE TO SEE the HEAD DISTRIBUTION AS follows?**

Figure 1: Heads in the aquifer

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>18.27</td>
<td>19.27</td>
<td>18.26</td>
<td>18.19</td>
<td>17.97</td>
<td>18.68</td>
<td>19.11</td>
<td>19.44</td>
<td>20.13</td>
<td>20.52</td>
</tr>
<tr>
<td>2</td>
<td>18.27</td>
<td>19.27</td>
<td>18.26</td>
<td>18.19</td>
<td>17.94</td>
<td>18.64</td>
<td>19.11</td>
<td>19.44</td>
<td>20.13</td>
<td>20.52</td>
</tr>
<tr>
<td>3</td>
<td>18.27</td>
<td>19.27</td>
<td>18.26</td>
<td>18.19</td>
<td>17.97</td>
<td>18.64</td>
<td>19.11</td>
<td>19.44</td>
<td>20.13</td>
<td>20.52</td>
</tr>
</tbody>
</table>

Or would you prefer:

Or perhaps:

**LET ME RE-STATE – VERY IMPORTANT!!!** If I get a paper with a cut and paste of MODFLOW output I will return it without grading --- and there will be NO "CHANCES" VIA Re-submission. If you do that the grade is a ZERO

**WOULD YOU LIKE TO SEE BUDGET AT ONE POINT IN TIME AS follows?**

Figure 2: You can clearly see the water is going into storage and the river is depleted

<table>
<thead>
<tr>
<th>CUMULATIVE VOLUMES</th>
<th>IN</th>
<th>OUT</th>
<th>RATES FOR THIS TIME STEP</th>
<th>L**3/yr</th>
<th>L**3/yr</th>
</tr>
</thead>
<tbody>
<tr>
<td>IN:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STORAGE</td>
<td>287.12E6</td>
<td>STORAGE =</td>
<td>8.00E8</td>
<td>STORAGE =</td>
<td>8.00E8</td>
</tr>
<tr>
<td>RIVER LEAKAGE</td>
<td>0.0000</td>
<td>RIVER LEAKAGE =</td>
<td>0.0000</td>
<td>RIVER LEAKAGE =</td>
<td>0.0000</td>
</tr>
<tr>
<td>RECHARGE</td>
<td>3156.8997</td>
<td>TOTAL IN =</td>
<td>3424.1353</td>
<td>TOTAL OUT =</td>
<td>3424.1997</td>
</tr>
</tbody>
</table>

| OUT:                |    |     |                           |        |        |
| STORAGE             | 0.0000 | STORAGE = | 0.0000 | STORAGE = | 0.0000 |
| WELLS               | 1800.0000 | WELLS = | 3.0000 | WELLS = | 3.0000 |
| RIVER LEAKAGE       | 1624.1998 | RIVER LEAKAGE = | 0.57E4 | RIVER LEAKAGE = | 0.57E4 |
| RECHARGE            | 0.0000 | RECHARGE = | 0.0000 | RECHARGE = | 0.0000 |
| IN - OUT = | -6.44E-02 | IN - OUT = | -1.57E-04 | IN - OUT = | -1.57E-04 |
NOTE: ModelMate does not simulate nor calibrate anything
MODFLOW simulates and
UCODE calibrates

THERE IS NO “TIME” IN STEADY STATE

Transient Work Requires Storage Parameters
- $S_s$ is specific storage
- Storativity or Storage Coefficient is $S = S_s \times$ thickness
- Similar to $K$ and Transmissivity

What do you know about values of $S$?
- Generally “small” numbers e.g. typically $1 \times 10^{-7}$ to $1 \times 10^{-4}$
  - when it approaches $1 \times 10^{-3}$ we call the formation a semi-confined aquifer

Say you use an $S_s$ of $8 \times 10^{-3}$ ft$^{-1}$ and the aquifer is 50 ft thick then $S = 0.4$ !!!!!

Recall assignment requires multiple transient stress periods (minimum 2)
- In your report, use a graph to show the stresses and their timing

Understanding Storage Term in the Budget (think of storage as an external reservoir):
- water OUT TO STORAGE occurs when water levels rise
  - this may be confusing because you picture that water is going into the aquifer
  - think of it in the way you had to think of it for water budgets in your basic hydro class

- VOL = $\Delta h \times$ area of cell $\times$ storage coefficient
  - storage coefficient is $SY$ or $S$ depending on aquifer condition (unconfined/confined)

- water IN FROM STORAGE occurs when water levels fall (same formula)

USE CHARTS RATHER THAN TABLES – Take advantage of GWChart
USE RATES rather than CUMULATIVE VOLUME
USE hydrographs – show locations other than pumping wells
must have data saved in output (via .oc file) to use GWChart
BUDGET – Generally USE RATES vs CUMULATIVE

HYDROGRAPHS – For heads, flows, and concentrations
What do we mean by Initial Conditions for a Transient run?
   It is not the same as for your steady state model
What are your options for setting these up?
   see notes and recall discussion on MAR 30
   Transient Modeling and GUIs  ASSGN #6 DUE
   PDF of class notes Transient Modeling.pdf

If the model results seem “odd” figure out the cause ... Usually it is an input error
   first submission is intended to get you feedback to improve learning and grades
   it was not intended to allow people to be late (although it can rescue you)
   it is highly unusual that you entirely understand your model results the first pass
   generally it takes at least 2 passes

WATCH MASS BALANCES FOR ALL TIMESTEPS!
   Often the biggest trouble is on the first time step of a stress period
   Why?
   How do we improve mass balance?
   Closure criteria / # iterations
      How do we control those?
      In solver package
   Time step size
      How do we control those?
      In dis package
      Period Length  -  # of steps  -  timestep multiplier
         typically multiplier > 1 (1.1-1.3)
      consider magnitude of stress change and size of last step in previous period