Classroom Watershed Setup

Most of these supplies can be purchased at Wal-Mart, the plumbing pieces can be easily found at HomeDepot. Before constructing your "classroom watershed" gather the following supplies:

Construction Materials[1] Needed:

~Available @ Wal-Mart~
1 ~ 28.3 liter Rubbermaid "SnapToppers"™ clear storage box with locking lid ($3.86)
1-2 ~ bags of inexpensive "polyfill" craft batting or "stuffing" ($ 2.50 each)
1 ~ 5-gallon pail with lid and handle (painter's bucket) ($ 2.50 + $0.97 –lid)
1 ~ Package of plastic drinking straws ($0.78)
1 ~ Small cube of green "floral clay" ($1.96)
1 ~ Package of tall (just able to fit inside the lidded Rubbermaid container) "Solo" brand clear plastic party cups ($2.12)
1 ~ Large, long "turkey" baster ($1.44)
1 ~ Utility sink overflow gauge ($5.58)
1 ~ 1 quart/liter clear plastic measuring cup with mL gradations ($3.96)
1/2 yard ~ brown shaggy felt cloth (@ $5.47/yard)
~Available @ HomeDepot~
5 ~ 1/2 inch threaded black or gray "risers" used for yard/lawn irrigation (10 for $0.99)
5 ~ 1/2 inch white PVC caps ($0.42 each)

Tools Needed:

- ü Scissors
- ü Electric drill
- ü Drill bit (The size needs to be just greater than or equal to the diameter of the straws
  - o Usually a 9/32th inch bit works well.)
- ü Blue permanent marker
- ü Ruler or measuring tape
- ü Pocketknife or steak knife

Watershed Setup Guidelines:

1. **Cutting out the watershed's "surface" ~** Using the lid of the Rubbermaid container as a template, lay the "shaggy" felt fabric on out on a table (shag down) and place the container lid (as you would on the container) on top of the fabric until it is there is enough fabric on the outside of the lid on all sides. Trace the lid "coverage" on the fabric with a permanent marker. Cut fabric

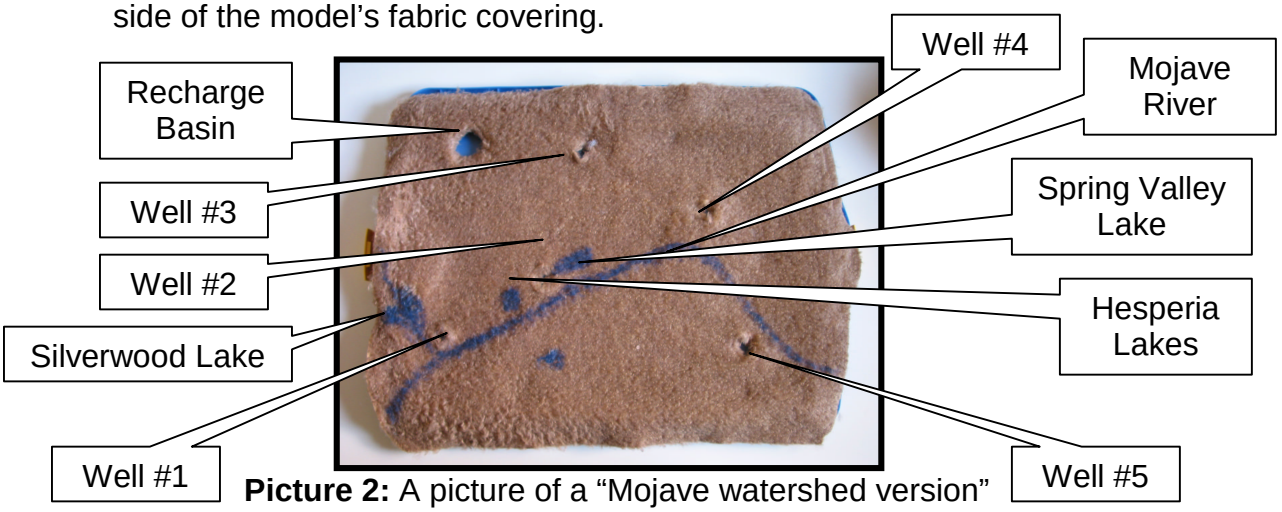
[1] All listed prices as of 3/15/03 in Southern California.

along the tracing line. Check an see if the fabric cutout just fits inside the lid of the Rubbermaid container.

2. **Filling the watershed with "simulated soil"~** Fill the Rubbermaid container with "pulls " of the "polyfill" batting until it is 3/4's full. [**Model Management**: When finished with the "Groundwater Over draught Simulation", the Polyfill and cover fabric can be tossed in a washing machine and spun "damp". If left to the open air for a week or so, the contents will dry out completely. Do not put the Polyfill and cover fabric into the dryer.]

Picture 1: Simulated soil Polyfill batting

3. **Marking out watershed "surface features" ~** Using a blue permanent marker, draw the watershed features (major rivers and lakes) on the shaggy side of the model's fabric covering.



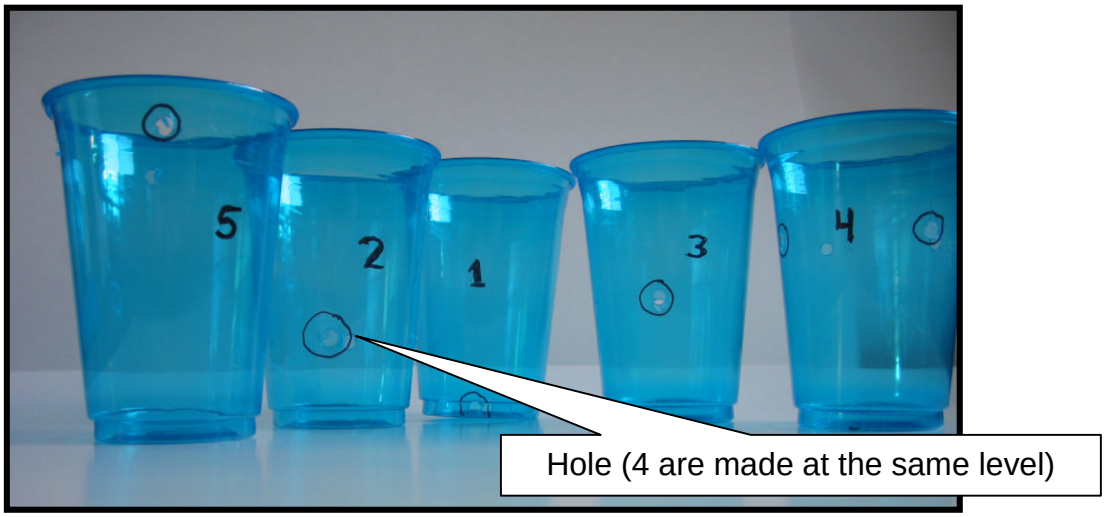
Picture 2: A picture of a "Mojave watershed version"

4. **Cutting the "monitoring wells"** ~ Once you marked and determined where the wells will be placed in your "watershed model", turn the model's fabric covering to the non-shaggy side and mark where the well hole will be cut. Bunch the fabric at the mark and using a pair of scissors, make two small half-inch cuts using only with the tips of the scissors. Both cuts should make an X shape with cross length no longer than one inch in length.
5. **Making "monitoring well caps" ~** Get the 1/2 inch PVC caps, a drill and a 9/32th inch drill bit. Mark the "inside the cap" center of each 1/2 inch PVC cap and drill from inside of each cap outward. Scrape the plastic drill debris from the newly drilled holes using a pocket or steak knife. Removing these plastic burs will help the drinking straw "well water depth monitors" rise and fall with a minimum of friction.
6. **Making "monitoring well casings" ~** Get the 1/2 inch risers, a drill and a 9/32th inch drill bit. Find the bottom of the riser (opposite the top where you will find a "hex" style wrench fitting). About one inch up from the bottom end, drill a hole completely through the riser. Next, drill a similar hole 90º away from the first. When finished, you should have four holes, at the same level, all 90º apart, one inch from the bottom of the riser. Scrape the plastic drill debris from the newly drilled holes using a pocket or steak knife.

Picture 3: "well" caps and casings after being drilled

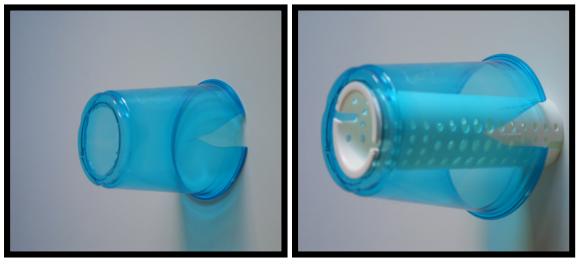
7. **Assembling "monitoring well casings and caps" ~** Screw the 1/2, drilled and scraped PVC "well caps" to the top (un-drilled) end of the drilled and scraped riser "well casings". Make sure they are "hand-tight".

8. **Making "monitoring well basins" ~** Get 5 of the "Solo" brand plastic cups and divide each cup's height into 5 equal distant portions starting from the bottom to just below the top of the cup's "lip". Using the same drill bit that was used to construct the "welling casing" caps", drill four hole (one in each cardinal direction of a compass (looking at the cup sitting on a table like a compass), or putting it another way, 12, 3, 6, and 9 o'clock positions (looking down at the cup opening as if it were the face of a clock) (see picture)



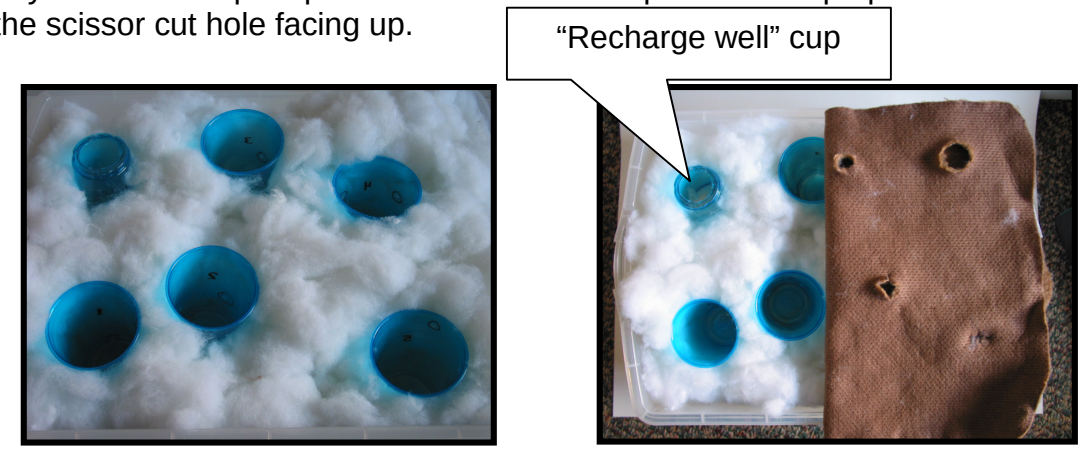
Picture 4: well cup hole locations

9. **Making "recharge basin/withdrawal well" ~** Get one of the "Solo" brand plastic cups, and the utility sink overflow gauge. Turn the cup over and place and center the non-lipped end of the utility sink overflow gauge onto the bottom of overturned cup. Trace the circumference of the overflow gauge onto the cup with a marker. Using a pair of scissors, carefully poke a "starting hole" in the middle of the circle that will be cut out. Next, cut out the traced circle with a pair of scissors. Trim the circle until the utility sink overflow gauge can be easily inserted into the hole in the overturned cup. Cut a small triangular piece of plastic from cup's open end. This will allow water to come and go from the cup's inner chamber.



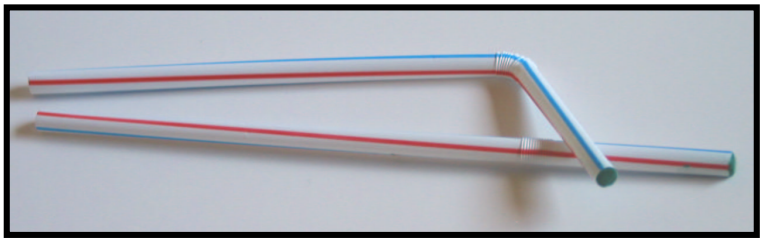
Picture 5: well cup hole and triangle location.

10. **Placing cup "monitoring well basins" ~** Get the five pre-drilled cups and the pre-cut watershed model fabric cover. Arrange the five cups inorder by drilled-hole height. Number the bottoms of the cups 1-5 starting with the cup with the lowest holes. Place cup one at the headwaters/top of the watershed model (containing deep aquifers/basins and deep wells) and cup five at the "down river" end of the watershed (containing shallow aquifers/basins and shallow wells). Place the other in order by hole-depth and/or cup number from the headwaters to the model's mouth. These placements will need to correlate with the cut well holes in the models fabric. Insert the cups (opening up) into the "polyfill" stuffing by either removing "pulls" of stuffing or by pushing it aside. Place the sixth cup, the **"recharge basin/withdrawal well",** in a corner on the "headwater" end of the model. Place this cup as far from any other well cup as possible. Remember to place this cup upside down with the scissor cut hole facing up.



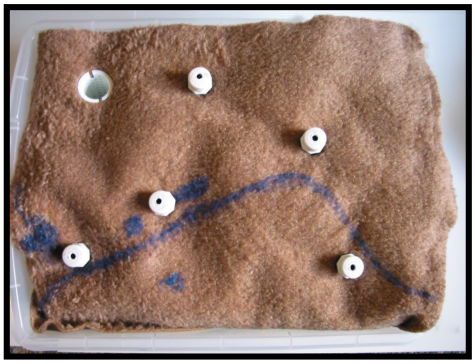
Picture 6: "Well Basin" cup placements

11. **Making plastic straw "well water level monitoring staffs" ~** Get straws and the floral modeling clay. Break off five pea-sized pinches of clay and roll them into balls. Carefully insert the clay into the bottom of the straws to create a watertight seal. Try to use equal amounts of clay on each straw. [**Model Management**: Numbering the staffs (1-5) helps later on with data analysis. Make sure the clay seals are watertight and stay watertight through the simulation. If these seals need to be reestablished, do not add additional clay as it will change the straws float sensitivity. If you are using the model for more than one class make a set of numbered straw "staffs" for each class. Remember, you will need to return the water that is removed after each class is finished with their daily simulation calculations.]



Picture 7: Sealed straw "Monitoring staffs"

12. **Putting it all together ~** By now, the Rubber made basin is filled with soil (polyfill), monitoring well basins (pre-drilled Solo cups), a recharge and withdrawal well basin (upside down cup). Place the pre-cut fabric over the model basin and align the well holes over the pre-positioned cups. Once this is completed insert the caped riser "monitoring well casings" through the fabric into the cups with the white PVC "well cap" poking out of the fabric. In each of the "monitoring well caps" insert the plugged end of a straw "well water monitoring staff". Make sure it can slip through the hole on its own and reach the bottom of the cup "well basin" on it own. If not, widen the hole with using the sharp end of a steak or pocketknife. [**Model Management:** The riser "well casing" could be held in place by some floral clay placed in the bottom of the cup. Make sure the clay does not obstruct the drilled openings at the bottom of the riser.]



Picture 8: Set up model

Picture 9: Baster and straw placement

Calibrating the Model Watershed's Tools

13. **Calibrating the 5-Gallon Bucket ~** The "Classroom Watershed Model" and the accompanying "Groundwater Over draught Simulation" curriculum is designed around a model that holds 20 liters of water. Using the one-liter measuring cup fill the five-gallon bucket with twenty one-liter portions. This should fill the bucket to about one inch below its rim. Mark this level for future use. For the purposes of this model and the numerical simulation behind it, one milliliter of water in the model is equal to 2115 acre-feet (ac-ft) of water in the actual basin (1 ml = 2,115 ac-ft).
14. **Calibrating the large Turkey baster ~** If your turkey baster is not already calibrated in useful milliliter units, get the baster, the permanent marking pen, the one liter measuring cup and a water source and calibrate the baster's cylinder in 5, 10, 15, 25, and 50 ml gradations.

Filling the "Classroom Watershed Model" with water

15. Make sure only 20 liters of water is put into the model's "recharge basin/withdrawal well". The "well basin" cups will want to float so you might want to fill these first, effectively weighting them down. Make sure there is no "polyfill" batting between the cup base and the Rubbermaid "watershed"

basin. Once the cup “well basins are full the straw “monitoring staffs” can be inserted in the into the white PVC “well casing caps. They are fun to watch as they respond to the basin rising water level as it is being filled.