Unit IV:

Water Resources

Unit IV Water Resources
Introduction

Water resources in a watershed refer to both the surface and ground water that is available for use by humans. Surface water generally starts with intermittent and small perennial streams which drain into larger streams, rivers, ponds or lakes. Many ponds are actually streams or rivers that have been dammed for specific purposes. Some of these ponds are used as drinking water reservoirs. Industry uses the reservoirs to provide water for their manufacturing processes or cooling processes. Farmers dam streams to use for irrigating crops or watering livestock. Surface water also provides wildlife habitat and recreational uses.

The most common use of ground water is to provide water for household, industry and crop irrigation. Aquifers are an area underground that usually contain well-sorted sand and gravel. "Well-sorted" means that the pieces of rock are all about the same size, so there are a lot of pore spaces between them. An aquifer is important because it can hold a lot of groundwater in the pore spaces, yet the water is easy to pump using wells.

Numerous intermittent and perennial streams drain portions of the Narrow River Watershed, including Mattatuxet River, Gilbert Stuart Stream, Crooked Brook, Mumford Brook, Crew Brook, Walmsley Brook, and several other unnamed streams. Of these, Gilbert Stuart Stream is the principal tributary of the Narrow River, contributing about 34% of the total freshwater flow. The two other principal streams in the watershed are Mumford Brook and Crooked Brook, which both discharge into Pettaquamscutt Cove. Silver Spring Lake, Shady Lea Pond, Carr Pond, and Sprague Pond are also other major freshwater features of the watershed.

The Pettaquamscutt Aquifer is a significant groundwater resource that underlies the northern portion of the watershed. Much of the groundwater is stored in aquifers composed of stratified sand and gravel deposited by glaciers during the Ice Ages that ended only twelve thousand years ago. These gravel deposits are capable of yielding large amounts of water and comprise a source of potable water for residents living in North Kingstown and part of Narragansett. The Pettaquamscutt Aquifer extends from the Silver Spring Lake area southeast to the Carr Pond watershed, including the Mattatuxet River. The town of North Kingstown has three wells in the Pettaquamscutt Aquifer. When fully operational, these wells have a combined pumping capacity of 750 gpm (gallons per minute). The dry-weather safe yield for the aquifer is 1.3 mgd (million gallons per day).

The Pettaquamscutt Aquifer is part of the Hunt-Annaquatucket-Pettaquamscutt aquifer system, which covers over sixty square miles in North Kingstown, East Greenwich, Warwick, West Warwick, and Exeter. In 1988, the U.S. Environmental Protection Agency designated these groundwater resources a "Sole Source Aquifer." This designation signifies that over 50% of the drinking water supply of the area is from groundwater and no reasonable alternate source of drinking water exists. Thus, protection of this resource is of utmost importance.

Ironically, most residents in the Narrow River Watershed get their drinking water from outside the Watershed. The northern section of Narragansett obtains its municipal supply from the Town of North Kingstown, while the rest of the town's municipal supply is provided primarily by the United Water Company from groundwater wells in the Mink Brook Aquifer in South Kingstown. United Water Company draws approximately 1.7 mgd from the Pawcatuck Sole Source Aquifer system to supply to the Town of Narragansett. Watershed residents living in the town of South Kingstown also get their drinking water from the Pawcatuck aquifer.

References

Applied Science Associates, Rhode Island Watershed Watch, SAIC Engineering, Inc., Urish, Wright, and Runge. 1995. *Narrow River Stormwater Management Study Problem Assessment and Design Feasibility,* prepared for the Towns of Narragansett, South Kingstown, and North Kingstown, p. 1-4

Ernst, L. M., L. K. Miguel, and J. Willis. 1999. *The Narrow River Special Area Management Plan.* Coastal Resources Management Council, South Kingstown, RI.

Town of Narragansett. 1994. *Narragansett Comprehensive Plan.*

Town of North Kingstown. 1991. *North Kingstown Groundwater Protection Plan.*

Town of South Kingstown. 1992. *Town of South Kingstown Comprehensive Plan.*

ACTIVITY I: LIVING BY THE SKIN OF AN APPLE

OBJECTIVE: To illustrate that only a small proportion of the earth provides us with our soil and water resources.

METHOD: An apple is used to represent the earth and give students a visual perspective of how little of the earth is suited for crop production and contains our potable water resources.

MATERIALS: apple, paring knife

PROCEDURE:

1. Show students the apple, and explain that it represents the earth.

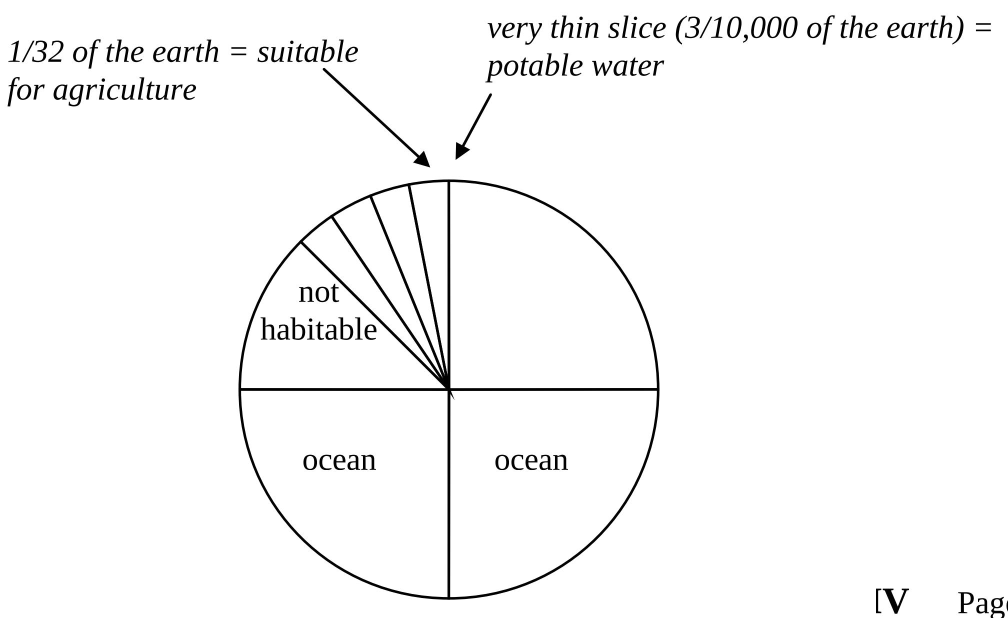
2. Cut the apple into four equal parts. Ask students to guess how many represent the oceans (3) and how many represent the land area (1).

3. Cut the land section in half lengthwise. Explain that one of these $1/8^{th}$ sections of the earth represents the land area that is suitable for human habitation. What makes the other section uninhabitable? (deserts, swamps, antarctic, arctic, mountains)

4. Slice this $1/8^{th}$ section into four equal parts. Only one of these $1/32^{nd}$ sections are suitable for agriculture. What makes the other three sections unsuitable? (too rocky, too wet, too hot, poor soils, human development)

5. Cut off a very thin slice of this $1/32^{nd}$ section. Explain that this very thin slice amounts to about $3/100^{th}$'s of one percent (.0003) of the Earth's surface. This is where all of our drinking water comes from!

6. Ask students for their reactions.



ACTIVITY II: **HOME WATER USE INVENTORY**

OBJECTIVE: To increase students' awareness of how much water we consume in our daily activities, and to provide them with ways to explore altering the volume of their use.

METHOD: Statistics of water volumes consumed by common daily activities in a typical household are presented; students have a chance to inventory their own household's use of water for a couple days and compare with others in the class.

MATERIALS: home water use inventory sheets for each student

PROCEDURE:

1. Draw a chart on the board, like the one below, but do not fill in the values under "gallons per use". Ask students to guess the volume of water used by each activity, and compare their guesses with the given value (of course values vary; these values are averages).

ACTIVITY	GALLONS PER USE
toilet flush	5
tub bath	36
shower	25
brush teeth, tap running	5
brush teeth, tap not running	½
hand wash dishes in basin	10
hand was dishes tap running	30
dishwasher	20
clothes washer	40
meal preparation	5

2. Which activities have options that are less wasteful of water? (bathing, dishwashing, teeth brushing)

3. Which could be modified to use less water? (shorter showers, low flow shower heads, toilet installments to reduce volume of water per flush)

4. Explain how to use "Home Water Use Inventory" sheets, and ask students to take them home and enlist their family in recording their water use for two days.

5. Have each student calculate their household's total volume of water use for each activity, and divide by the number of people in the household. If they divide the result by two, they end up with the volume of water used per person per day for each activity.

6. Which activity used the most total water? Was this the same in every household?

7. Did your households find themselves altering their water habits to reduce water use? If so, what methods were used to reduce water use?

8. Should we try to reduce the volume of water we use? Why or why not? See "Sources for Materials" section for information on how to obtain water conservation devices for the home.

9. What other ways do people use water? (agriculture, industry, recreation, electricity, transportation, etc.)

10. What else on this planet do humans share their water with?

11. Share resources with students that will enable them to explore water conserving devices for their homes. Low-flow shower heads, sink faucet heads, toilet dams, etc. may be obtained from:

    Your local water department or hardware store.

    Companies such as Seventh Generation, Products for a Healthy Planet Colchester, VT. 1-800-456-1177; *seventhgenertion.com*

HOME WATER USE INVENTORY

PLEASE POST IN BATHROOM

Directions: put a tally mark in the proper column each time that any of the following activities is performed.

ACTIVITY	**DAY 1**	**DAY 2**	= total X # gallons	= total/#people = total/2 days = final gpd*
toilet flush			x 5 =	/ = /2 =
tub bath			x 36 =	/ = /2 =
shower			x 25 =	/ = /2 =
teeth brushing (tap running)			x 5 =	/ = /2 =
teeth brushing (tap not running)			x .5 =	/ = /2 =

* gpd = gallons per person per day

TOTALS: ____________ per household ____________ per person __________ gpd*

HOME WATER USE INVENTORY

PLEASE POST IN KITCHEN

Directions: put a tally mark in the proper column each time that any of the following activities is performed.

ACTIVITY	**DAY 1**	**DAY 2**	= total X # gallons	= total/#people = total/2 days = final gpd*
hand washing dishes (tap running)			x 30 =	/ = /2 =
hand washing dishes (using basin)			x 10 =	/ = /2 =
dishwasher			x 20 =	/ = /2 =
clothes washer			x 40 =	/ = /2 =
meal preparation			x 5 =	/ = /2 =

* gpd = gallons per person per day

TOTALS: ____________ per household ____________ per person ____________ gpd*

ACTIVITY III: WHERE DOES OUR WATER COME FROM?

OBJECTIVE: Students will learn that our water supply comes from surface and groundwater resources; they will learn about how the water cycle replenishes these resources and about their relative abundance.

METHOD: An overhead is used to present a comprehensive diagram of the water cycle, and a demonstration is used to help students visualize the relative abundance of surface and groundwater resources.

MATERIALS: water cycle diagram on an overhead transparency, overhead projector and screen, 3 clear jars

BACKGROUND INFORMATION:

1. The **water cycle** is the sun-powered movement of water between the earth and the atmosphere. The steps of the water cycle include:

<u>Evaporation:</u> the sun heats water on the Earth's surface, turning it into water <u>vapor</u>, which is water in its gaseous form. The water vapor enters the atmosphere.

<u>Transpiration:</u> the movement of water from within the leaves of plants into the air. This is also a process powered by the sun, whereby water turns into vapor.

<u>Condensation:</u> as water vapor rises, it cools, and returns to its liquid state, forming clouds.

<u>Precipitation:</u> as clouds become saturated with moisture, water in the form of rain, sleet, hail, and snow, falls from the clouds in the atmosphere onto the earth.

2. When water falls onto the earth, it may directly enter a surface water body such as a stream, river, lake, or ocean. Some may directly infiltrate into the ground. Some water that hits the earth becomes <u>runoff</u>; it flows over the ground until it eventually enters a surface water body or infiltrates into the ground.

3. **Groundwater** is water that is stored underground. An <u>aquifer</u> is the beds of sand, gravel, or rock that store and move ground water. The <u>water table</u> is the top of the ground water supply. It is not always level. It has ups and downs just as the land above has hills and valleys.

4. Aquifers lie on top of <u>impervious</u> layers of rock, which do not let water through. Clay and shale are examples of impervious rock. When an aquifer lies between two impervious layers, it is an <u>artesian aquifer</u>, because it is under pressure. A <u>water table aquifer</u>, on the other hand, is not under pressure, because it does not lie beneath an impervious layer. The top of a water table aquifer is the water table.

5. When a well is drilled into an artesian aquifer, the water gushes out because the well hole releases the pressure that the water is under. When a well is drilled into a water table aquifer, the water in the well does not rise above the water table, and thus a pump is used to get the water out.

6. Groundwater is replenished by rain that enters recharge areas. Water also often flows freely between surface and groundwater. A spring is an area where, because of some geological phenomenon, the water table is above the surface of the land, and thus water flows out naturally from the ground.

7. Out of all the freshwater on the earth:

   76% is tied up as ice in the poles and in glaciers
   23.6% exists as groundwater
   0.4% exists as surface water

PROCEDURE:

1. Show students the water cycle diagram on the overhead. Discuss the movement of water through evaporation/transpiration, condensation, and precipitation. What provides the energy for this movement? In what parts of the cycle is water in liquid versus gaseous form?

2. Discuss surface versus groundwater, runoff, aquifers, wells, recharge areas, springs. What is the fate of water that hits the earth? What would happen to the water table if it didn't rain all summer? How would this affect streams, lakes, springs, and our aquifers, wells, and reservoirs?

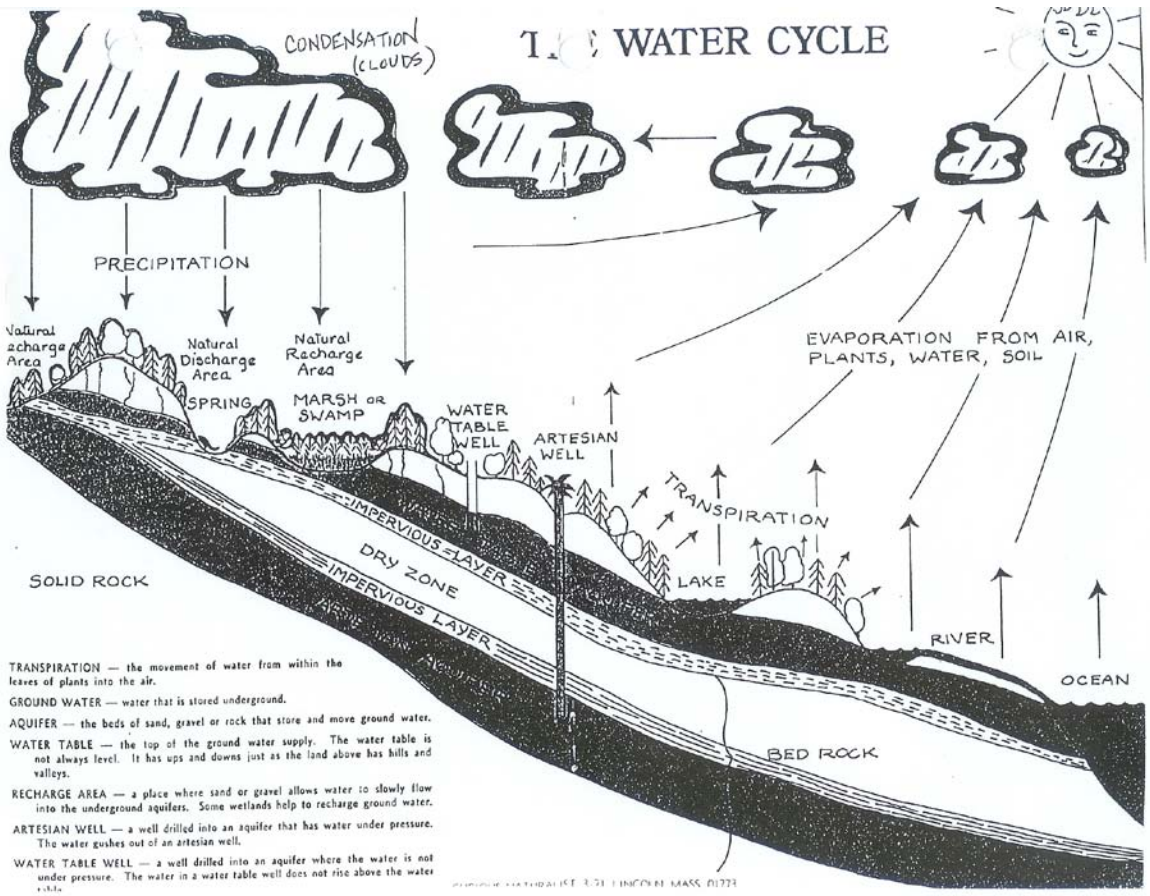
3. Show students a glass jar full of water. Explain that it represents all the fresh water on the earth.

   a. Pour out 76% into an empty jar, explaining that this represents all the water that is frozen at the poles and mountain tops.

   b. Pour out almost all the rest, 23.6%, explaining that this represents all the freshwater that is under the ground.

   c. The remaining drops, 0.4%, represent all the fresh water in surface water bodies, including all our reservoirs.

   d. Of all our liquid freshwater, where is most of it found?


CONDENSATION
(CLOUDS)
WATER CYCLE
PRECIPITATION
Natural Discharge Area
Natural Recharge Area
SPRING
MARSH OR SWAMP
WATER TABLE WELL
ARTESIAN WELL
EVAPORATION FROM AIR, PLANTS, WATER, SOIL
TRANSPIRATION
LAKE
RIVER
OCEAN
SOLID ROCK
IMPERVIOUS LAYER
DRY ZONE
IMPERVIOUS LAYER
BED ROCK
TRANSPIRATION — the movement of water from within the leaves of plants into the air.
GROUND WATER — water that is stored underground.
AQUIFER — the beds of sand, gravel or rock that store and move ground water.
WATER TABLE — the top of the ground water supply. The water table is not always level. It has ups and downs just as the land above has hills and valleys.
RECHARGE AREA — a place where sand or gravel allows water to slowly flow into the underground aquifers. Some wetlands help to recharge ground water.
ARTESIAN WELL — a well drilled into an aquifer that has water under pressure. The water gushes out of an artesian well.
WATER TABLE WELL — a well drilled into an aquifer where the water is not under pressure. The water in a water table well does not rise above the water

ACTIVITY IV: **TESTING OUT AN AQUIFER**

OBJECTIVE: Students will learn how an aquifer and well functions, and how the hydrology of surface and groundwater resources is connected.

METHOD: Students are able to experiment with a three-dimensional model of an aquifer and well.

MATERIALS: two vertical flow columns*, one of sand and gravel, one of just large gravel (or materials to build your own – see instructions); materials for model aquifer*: aquarium, ¼-½" pebbles, 3" diameter x 8-12" long PVC plastic tube, window screening, strong rubber band or duct tape, turkey baster, watering can, green food coloring

BACKGROUND INFORMATION:

1. See #3-6 on groundwater, aquifers, and wells, in Activity III: “Where Does our Water Come From?”

2. Since an aquifer is the beds of sand, gravel, or rock that store and move groundwater, it is the <u>saturated</u> portion of the Earth’s crust. Saturated means that the pore spaces between the sand grains are filled with water. Thus an aquifer lies in the portion of the soil called the <u>zone of saturation</u>. The <u>zone of aeration</u> is the soil zone in which pore spaces are not completely filled with water – instead some air exists in these pore spaces. Plant roots live in this zone because they need aeration as well as moisture. The <u>water table</u> divides the zone of saturation and the zone of aeration.

3. When a well is drilled into a water table aquifer, a pump is used to draw the water out of it. When it rains, the aquifer recharges as water infiltrates into the ground. If too much water is pumped out of the aquifer too quickly for the rain to replenish the water table level will go down, and thus the level of water in the well will also go down (these levels are the same in a water table aquifer). If there is any body of surface water associated with the aquifer, its water level will also decline with excessive pumping.

4. Pollutants can travel through an aquifer. Some pollutants may “stick” to the soil or sand particles, while others which can dissolve in water will travel with the groundwater. Thus if a pollutant enters an aquifer, it may turn up in a well as the water in the aquifer is pumped into the well.

5. Water usually flows more quickly through well-sorted, coarser grained materials, because the pore spaces are larger and form more direct routes for flow. Thus well-sorted gravel would make a better aquifer than an unsorted mixture of gravel and sand because it would supply more water per time unit.

PROCEDURE:

1. Show students the two vertical columns of sand and sand & gravel. Have them pour an equal amount of water into the top of each, starting at the same time, and record the time it takes for water to travel through. Ask them to try to explain the results. Which column would make a better aquifer? Why?

2. Explain the terms “zone of saturation” and “zone of aeration” by drawing the following diagram on the board. The concept of aeration versus saturation may be simulated by a damp versus soaked kitchen sponge. The saturated sponge will accept no more water, and any air has been replaced by water. Point out the importance of the pore spaces between particles of soil, sand, or gravel.

3. **Building the model aquifer** (see diagram below): Using the rubber band or duct tape, attach window screening to one end of the clear PVC tube. This is your “well”. After placing the well in one corner, fill the aquarium (around the well, not inside it) with pebbles.

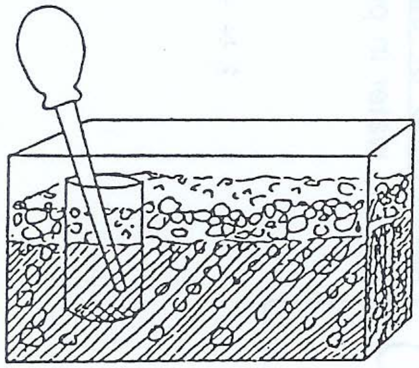
4. Have students pour water tinted with green food dye onto the aquifer with a watering can to simulate rain. (Colored water allows you to more clearly see the water table level). With erasable markers have other students draw lines on all sides of the aquarium where they see the top of the water. This is the water table. Why does the level of water in the well match the water table?

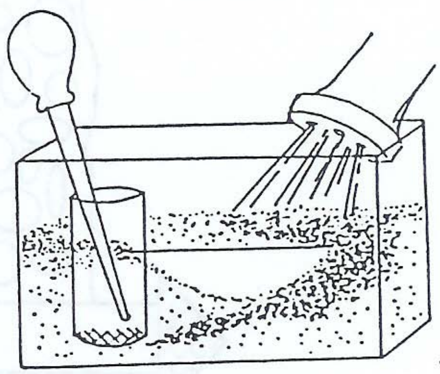
5. Ask students if the water table ever moves? If so, what makes it go up (precipitation, floods)? What makes it go down (droughts, pumping wells)?

6. Let students take turns using the turkey baster “pump” to remove water from the well. What happens to the water table? Using a different colored erasable marker, have students draw a line where they see the new water table. See if students can match a rainfall rate to a pumping rate to keep the water table constant.

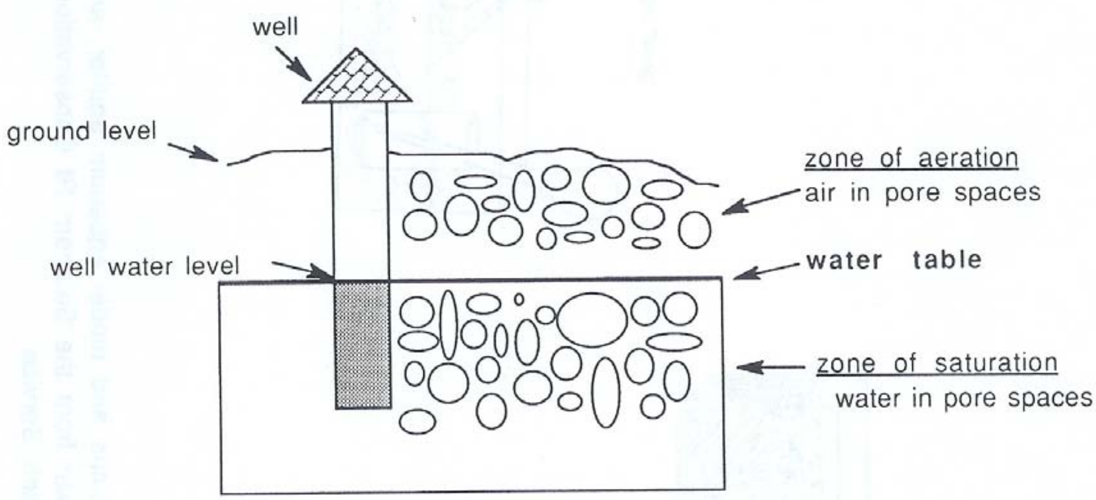
7. Ask students if they have ever seen the water table? Create a “pond” depression in the zone of aeration. Add more water to fill up the pond. Have students draw a new line to show how the level of the water in the pond is even with the level of water in the ground. What happens when water is pumped out of the well? How are the surface and groundwater related?

8. Discuss how this model aquifer differs from a real aquifer. Most aquifers consist of a mixture of sand, gravel, and rock or variously sized particles. The flow would be much slower than in this aquifer of equally large sized gravel pieces. Recall the difference in flow rate between the vertical column with the sand and gravel mixed versus the column with just the gravel.





* Groundwater models are available for purchase from Envision Environmental Education (www.gwmodel.com), but may be available on loan from your local state environmental agency, cooperative extension service or conservation district. It is worthwhile to check around. They are quite expensive to purchase ($500 - $1,000).



Instructions to build a vertical column aquifer model

(Two options are provided. The first uses very sturdy material that will last for many years and gives good results. The alternate option is much less expensive and laborious, but results may vary.)

TYPE 1. PVC Pipe

Materials:

- clear PVC pipe 1.5 – 3 feet long, 1.5 – 3 inches diameter
- end cap with the same diameter as PVC pipe (does not need to be clear)
- PVC pipe cleaner and glue
- ¼ to 3/8 inch male threaded to hose insert
- Teflon tape
- 2 feet of clear polyvinyl tubing; inside dimension to fit insert tightly
- clamp to restrict the flow through tubing
- glass wool (used for aquarium filters)
- approximately 2-3 cups of gravel (use large-grained aquarium gravel)
- more gravel, a mixture of sand and gravel, or other medium to be tested (enough to fill the vertical column)
- jar to catch outflow water
- a drill bit slightly smaller than the insert
- stand to hold filter assembly (optional)

Assembling the Apparatus:

1. Cut pipe to desired length with a hack saw. Clean pipe end and inside of end cap with PVC cleaner. Let dry. Put PVC glue on the end of the pipe and the inside of the cap. Push pieces together and hold for 30 seconds.

2. Drill hole approximately one inch above the top of the end cap. The drill bit hole must be one size smaller than the insert diameter. Use a tap to thread the opening of the PVC pipe.

3. Put Teflon tape on the insert and screw it into the PVC pipe.

4. Push polyvinyl tubing into the insert. The clamp should be placed on the opposite side of the tubing.

5. Put gravel into the pipe above the opening of the insert and approximately one inch of glass wool.

6. Add medium to be tested. Best if use large-grained gravel in one, and a mixture of large-grained gravel and sand in another, for comparison. Silt can be used, but will tale many hours to drain.

TYPE 2. Soda Bottles
Materials:

- 2 clear plastic liter size soda bottles (best if they are clear throughout the whole bottle)
- pieces of nylon hose
- elastics

Procedure:

1. Cut the bottom third out of soda bottle.

2. Cover the neck of the soda bottle with a piece of nylon and secure with elastics.

3. Invert the top of the bottle into the bottom, so that the neck is facing down into the bottom. If cut correctly, this should be a secure fit with the bottle able to standing stable.

4. Add medium to be tested.

ACTIVITY V: **A DAY IN THE LIFE OF A DROP OF WATER**

OBJECTIVE: Students will understand the water cycle and the path that water travels through in a groundwater delivery system, from atmosphere to groundwater, to their tap.

METHOD: A guided imagery helps students understand the water cycle and a water delivery system by taking them through the birth of a raindrop, and the route that this drop might take through the ground, into a well, and up into a tap in a house.

MATERIALS: A copy of the fantasy, “A Day in the Life of a Drop of Water”.

PROCEDURE:

1. Ask students to close their eyes, relax, take three deep breaths and slowly exhale to clear their mind of all thoughts. Read the story, “A Day in the Life of a Drop of Water”, and have them imagine that they are the main character in the story.

2. After you finish reading the story, ask students how they felt. Have them describe some of the things they imagined during the story. Drawing is an excellent way for them to do this.

3. Discuss what was happening at different points throughout the story: what was happening when the drop started to “fly” off the blade of grass? (evaporation) What did the drop of water turn into at that point? (water vapor molecule) What was happening when the character started to feel wet again, up in the sky? (condensation) What happened next? (precipitation – drop fell as rain) What are these transformations an example of? (the water cycle)

4. Why did other water molecules stick to the character as it started flowing on the ground (liquid water molecules adhere to each other) What happened when it became dark? (the drop went underground) Why were there different textures under the ground – why was it soft first, and then hard? Drop traveled first through the soil, then through underlying sand and gravel) Why did the water drop move less slowly as it went deeper underground? (pore spaces are larger in sand and gravel, and water movement is faster)

5. Why did the drop start moving sideways instead of down? (aquifer flow is parallel to the underlying bedrock) What was the huge hole filled with millions of water drops? (well) What was the force that started to suck the water drop upward? (pump) At what point did the water drop enter a pipe? (when it heard echoing sounds and smelled rust) What happened when the drop hit its head on a hard metal wall – why did it switch traveling directions? (pipe joints)

6. What happened when the drop plunged into a blinding light? (came out a faucet) What was the “clear pool?” (a drinking glass) What were the strange flesh-like smudges and reddish/pink oval creature with wart-like bumps? (a person’s hand through the glass, and the person’s tongue) Where did the drop end up? (inside a person’s body!)

7. An alternative procedure: stop the story sometime in the middle, have students write their own endings, and share.

A Day in the Life of a Drop of Water

Expanded from “Birth of a Raindrop”, from Keepers of the Earth, by Michael Caduto and Joseph Bruchac.

You are a small drop of water sitting on top of a fresh blade of green grass. It is mid-summer and the sun is shining. You are wondering, “Will I ever become unstuck from this blade of grass?”

A playful summer breeze blows through the meadow, causing your blade of grass to wave back and forth. The sun feels very strong and you feel yourself becoming more and more full of energy. You feel so hot and alive that your insides are rushing around violently. Suddenly the energy is so great that you are lifted right up into the sky! Your body feels a whole new sensation… you are light, dry and flying! Your insides are still moving around furiously. The wind helps to carry you up and over the treetops.

As you rise higher and higher, you feel light as a feather. Down below, the meadow that you came from looks like a dot on the Earth. The wind carries you into a dark gray cloud. You hear a loud cry and almost bump into a large, black bird with a white head. Here in the cloud there are millions and billions of other water vapor molecules rushing around and bumping into one another. “Hey, watch it!” You yell as a careless one bumps into you. “Ouch! It’s too crowded here!”

You are relieved when you begin to feel that familiar moisture feeling again. As you become wetter, you feel heavier, and you move much more slowly. Soon you become so heavy that you start to fall back to Earth. All around you other raindrops are falling. Lower and lower you sink. In every direction you look, there are raindrops. The whole world seems to be wet.

You look down again and the wet blur is becoming clearer. A long, black highway stretches below you, running beside a large expanse of evergreen forest. You hope to land on the forest! As the end of your fall draws near, you close your eyes bracing yourself for the impact… SPLAT! OUCH! Was it the highway asphalt? But your movement doesn’t stop. You just move much more slowly. As you open your eyes, you are trickling down the crack of a huge boulder on the edge of the forest. A few other raindrops have stuck onto you and you’re all flowing together. More and more drops collide and join your blob, running down the rock. Your speed picks up, and then finally…. ttthump! You all have landed on the soft earth. The impact was gentler this time but it has broken the blob apart.

Once again you are alone and suddenly it is very dark… oops… one droplet friend has attached to you as you find yourself slowly creeping into a strangely shaped crevice between two fuzzy particles of soil. You feel yourself being pulled down, down, into crevice after crevice…. like little tunnels in the soil. Slowly twisting, turning, percolating, the musty smell of the soft, damp, cool earth comforts you. The softness is disappearing, though, as you go further down and the soil particles are getting harder and bigger with larger crevices that you flow through not quite so slowly now.

More of your droplet friends join you. You all notice that you now seem to be pulled sideways instead of down. A strange force is somewhere off to your right and you're getting sucked toward it, but you still all have to find your way through the twisting cave-like spaces between the grains of sand and gravel… the force becomes so strong that you get pulled… ffffttt! Splash! Into a huge hole filled with thousands… millions… of your water drop friends…. You're all swishing and splashing about… but you can still feel the strange force sucking you… it is much stronger now, and upwards. It is still very dark… suddenly you hear a strange echoing sound… all your droplet friends splashing against metal… there is a faint smell of rust now. The force is still pulling you up, when suddenly…

OUCH! Your head hits a hard metal wall and you get pulled sideways again, this time to your left. Faster and faster you travel… OUCH! Your left side hits another metal wall and the force pulls you straight up again. Now you are traveling as fast as you were the last time you saw the light of day… rolling down that boulder on the edge of the forest. But it is still dark and so it is pretty scary to be going so fast and not see where you are going…

Suddenly with a violent jerk you get flipped over and you plunge head first into a blinding light… SPLASH! When the turbulence settles, you turn yourself upright and you see that you're surrounded by your droplet friends, splashing, swishing about in a very clear pool. When you look around, you see these strange flesh-like smudges all around you. The sucking force is gone but you feel yourself and your friends being turned upside down, like you're in a swimming pool that a huge giant is flipping over… and whoosh… it goes completely dark once again. In your last glimpse of light, you were able to see that you were heading straight towards an extremely strange, reddish-pink oval creature with bizarre wart-like bumps all over it. After seeing such a sight, you're glad it's dark again. You're also glad to feel that wherever you are, the pace has slowed way down. Are you in the soil again? Gosh, it seems much warmer than the soil. It's sort of a cozy feeling after all the splashing and cold metal walls and weird sucking forces and strange sights… maybe it's time for a rest.

ACTIVITY VI: FRESH WATER RESOURCES IN THE (YOUR WATERSHED HERE)

OBJECTIVE: Students will learn where their water comes from and the significance of the various forms of water resources in the (**your water shed here** [*Flat River Reservoir Watershed*]).

METHOD: Students will learn through discussion and map study.

MATERIALS: GIS map of the your watershed showing surface water, groundwater reservoirs and recharge areas; USGS topographic maps of the watershed; map of Rhode Island.

BACKGROUND INFORMATION:

1. Describe surface waterways vs. groundwater in your watershed **Example:** *The Flat River Reservoir watershed has several surface waterways and limited groundwater.* Groundwater is water that fills pores, channels, or cracks in the permeable soils or rock beneath the surface of the earth. Describe how groundwater is stored in your watershed. **Example:** *In the Flat River Reservoir watershed the groundwater in this watershed is stored in stratified sand and gravel deposits left by glaciers. These deposits are known as glacial outwash.*

2. Describe how most water is supplied to your town and watershed area. **Example:** *60% of drinking water in Coventry is provided by private groundwater wells, and the Kent County Water Authority (KCWA) supplies the remainder. The KCWA does not at this time provide water service west of the Town Hall on Flat River Road, which lies just inside the eastern border of the Flat River Reservoir Watershed. This means that drinking water in the watershed is almost solely provided by private wells.*

3. Describe how the rest of the water is supplied and any concerns about the water. **Example:** *Water sources used by KCWA for the eastern side of Coventry are the Mishnock and Spring Lake Wells located in Coventry, and KCWA contracts from the Providence Water Authority for use of the Scituate Reservoir. Another well located in Coventry, the Washington Well, is currently closed due to contamination. Protection of drinking water from contamination by the effects of urbanization and land use, particularly in the densely populated east side of Coventry, is an area of concern.*

PROCEDURE:

1. Have students study maps of Rhode Island pointing out your watershed. Where do most people in the watershed get their water? How does the water get to the residents who need it? Why do people in cities often use reservoirs rather than

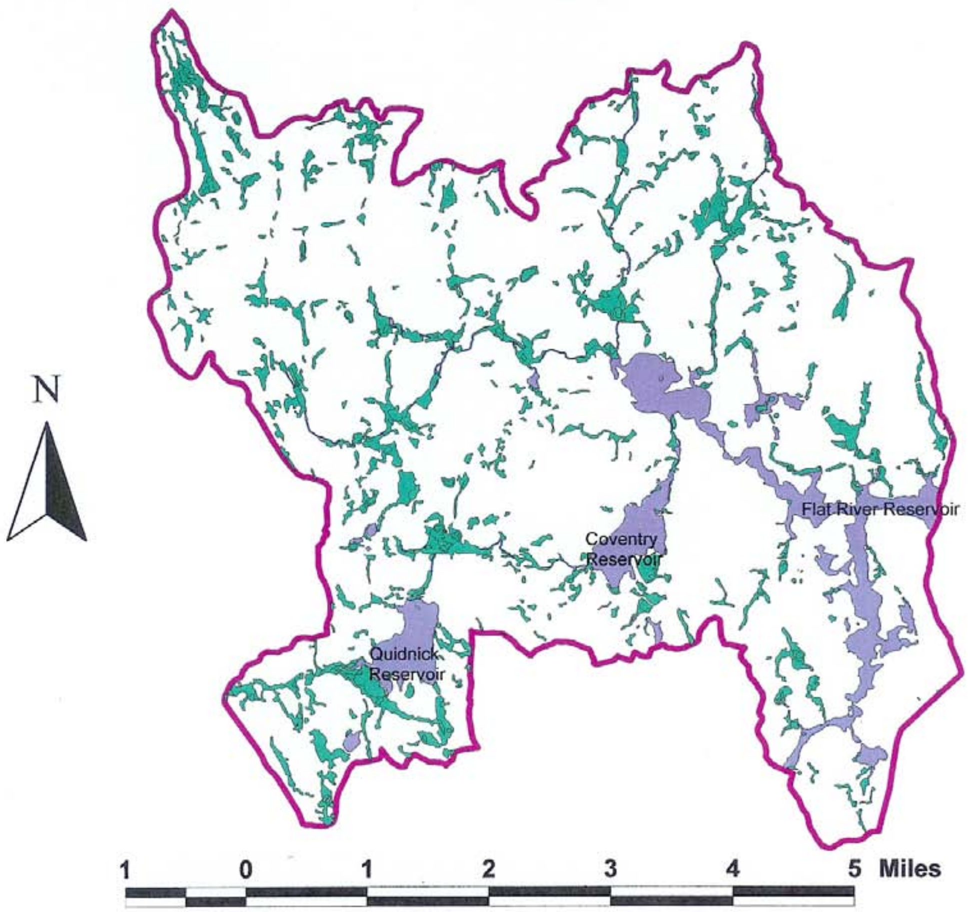
groundwater? Why can people in rural area often rely more on groundwater? Do all rural areas use groundwater as their drinking water source? Why not?

2. Have students study GIS maps, pointing out groundwater reservoirs (aquifers) and critical recharge areas. Ask questions about protection and use of your water supply. People in the watershed get their drinking water from the ground; can you locate the wells and the wellhead protection areas that provide this water? What is the importance of the wellhead protection area? Do people outside the watershed in Coventry and the surrounding towns get their water from the ground? Why don't most Warwick residents get their drinking water from the groundwater resources found in the northern part of the watershed?

3. Ask students where the water in their taps at home actually comes from. Discuss private versus community, or public wells. Have students ask their parents if they have a private well, if they are linked to a public well, or if they purchase water from a water supplier. Who supplies their water? Have students share their findings. Have them find the community wells on the GIS maps.

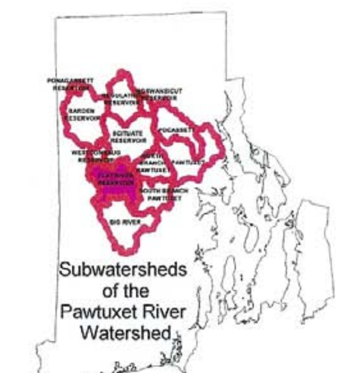
4. Point out your watershed. Discuss the nature of watersheds and sub-watersheds. Discuss how surface reservoirs are constructed.

WETLANDS AND SURFACE WATER
Flat River Reservoir Watershed



Wetlandsinflatrivres.shp
Flat River Reservoir Watershed Boundary
Rivers
Ponds

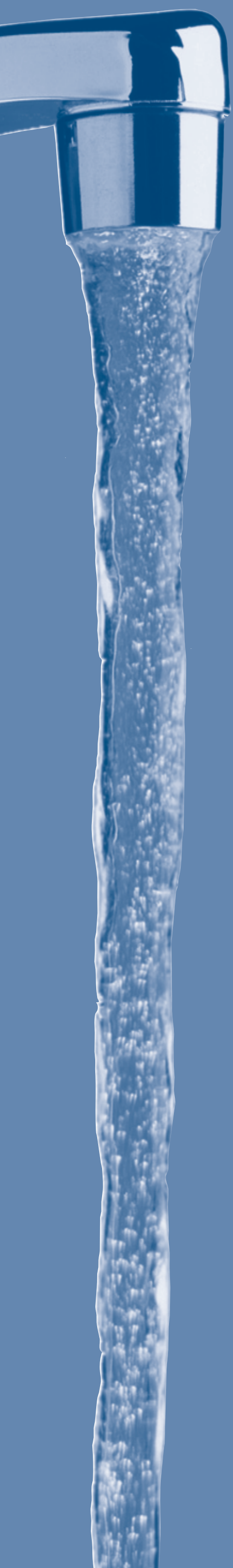
DATA SOURCES:
All data from RIGIS99Vector Database.



LOCUS MAP

Southern Rhode Island Conservation District, 11/01

Rhode Island Department of HEALTH
UNIVERSITY OF Rhode Island



Healthy Drinking Waters for Rhode Islanders

SAFE AND HEALTHY LIVES IN SAFE AND HEALTHY COMMUNITIES

Drinking Water Wells

WHEN YOU TURN ON THE FAUCET TO GET A DRINK OR TO TAKE A SHOWER, do you know where your water comes from? Over 100,000 Rhode Islanders drink groundwater supplied by a private well on their property. Groundwater is water beneath the earth's surface that fills and saturates the spaces between sediment particles as well as the cracks and crevices within bedrock. When rain falls or snow melts some of the water percolates into the ground and becomes part of the groundwater.

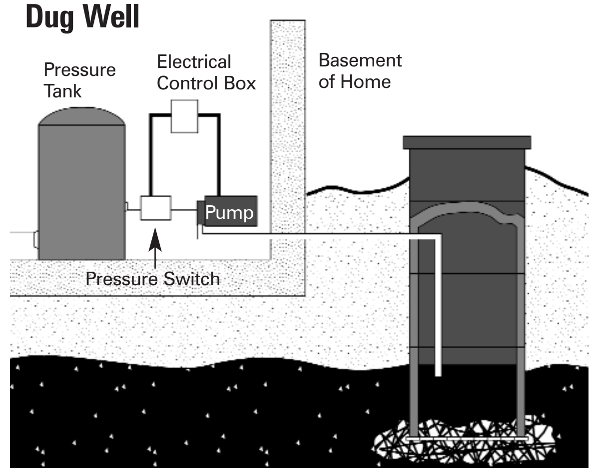
Private wells currently are not regulated by the U.S. Environmental Protection Agency (EPA). As an individual well owner, you are responsible for the quality of your own water. Individual well owners do not benefit from the public health safeguards provided by a regulated and regularly tested public water supply system. The Rhode Island Department of Health, (HEALTH), Office of Drinking Water Quality can assist private well owners with water quality concerns, but responsibility for wellhead protection, adequate well maintenance and water testing falls mainly on the homeowner.

So, what exactly is your well, where is it located and what can you do to maintain it? Simply put, your well is a circular hole that extends into the earth until it reaches an underground water-bearing formation, known as an aquifer. Three basic types of wells are common in Rhode Island: dug wells, driven wells, and drilled wells.

Well Construction

The Rhode Island Department of Environmental Management, (RI DEM), regulates the construction of private wells. A registered well driller should install a new well or improve or repair an existing well. These professionals are knowledgeable of the RI DEM private well construction specifications. For more information on these specifications, see RI DEM's website at: http://www.state.ri.us/dem/programs/benviron/water/permits/privwell/index.htm.

Dug Well



Unless noted otherwise, all graphics adapted from URI's Cooperative Extension

Dug wells

Dug wells are holes in the ground dug by shovel or backhoe. Historically, a dug well was excavated below the groundwater table until incoming water exceeded the digger's bailing rate. The well was then lined (cased) with stones, brick, tile, or other material to prevent collapse. It was covered with a cap of wood, stone, or concrete. Since it is so difficult to dig beneath the groundwater table, dug wells are not very deep. Typically, they are only 10 to 30 feet deep. Being so shallow, dug wells have the highest risk of becoming contaminated. To minimize the likelihood of contamination, your dug well should have certain features. These features help to prevent contaminants from traveling along the outside of the casing or through the casing and into the well.

THE STATE OF RHODE ISLAND DEPARTMENT OF HEALTH AND THE UNIVERSITY OF RHODE ISLAND COOPERATIVE EXTENSION DEPARTMENT OF NATURAL RESOURCES SCIENCE

Dug Well Construction:

- The well should be cased with a watertight material (for example, tongue-and-groove precast concrete) and a cement grout or bentonite clay sealant poured along the outside of the casing to the top of the well.
- The well should be covered by a concrete curb and cap that stands about a foot above the ground.
- The land surface around the well should be mounded so that surface water runs away from the well and is not allowed to pond around the outside of the wellhead.
- Ideally, the pump for your well should be inside your home or in a separate pump house, rather than in a pit next to the well.

Driven Well Construction:

- Assembled lengths of 2" to 3" diameter metal pipes are driven into the ground. A screened "well point" located at the end of the pipe helps drive the pipe through the sand and gravel. The screen allows water to enter the well and filters out sediment.
- The pump for the well is in one of two places: on top of the well or in the house. An access pit is usually dug around the well down to the frost line and a water discharge pipe to the house is joined to the well pipe with a fitting.
- The well and pit are capped with the same kind of large-diameter concrete tile used for a dug well. The access pit may be cased with pre-cast concrete.

Land activities around a dug well can also contaminate it. Examples include disposal of household chemicals or oil on the ground or down the drain, car or other vehicle maintenance, failing septic systems, lawn fertilization and pesticide application, roadway runoff, and pet or livestock waste. Protecting the water quality of your dug well means that you must monitor activities around it and reduce or eliminate potential contamination sources.

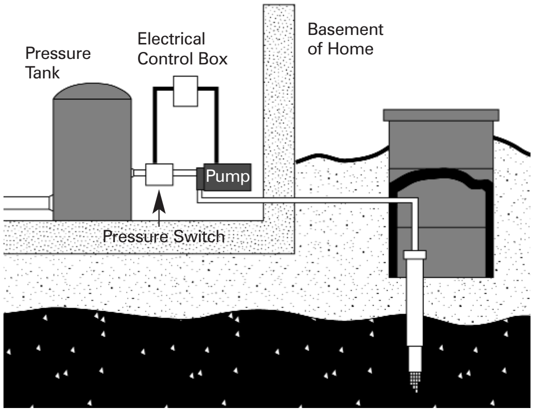
While dug wells have been used as a household water supply source for many years, most are "relics" of older homes, dug before drilling equipment was readily available or when drilling was considered too expensive. If you have a dug well on your property and are using it for drinking water, check to make sure it is properly covered and sealed. Another problem relating to the shallowness of a dug well is that it may go dry during drought when the groundwater table drops.

Driven (sand-point) Wells

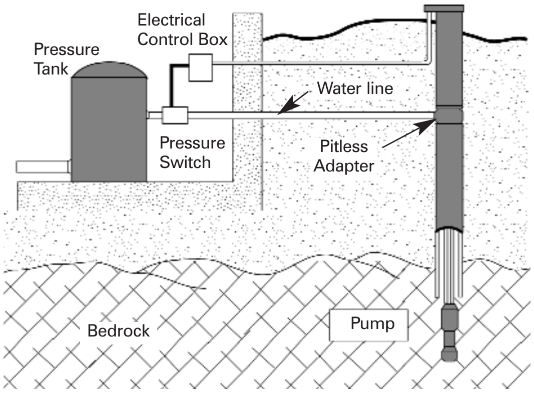
Like dug wells, driven wells pull water from the water-saturated zone above the bedrock. Driven wells can be deeper than dug wells. They are typically 30 to 50 feet deep and are usually located in areas with thick sand and gravel deposits where the groundwater table is within 15 feet of the ground's surface. In the proper geologic setting, driven wells can be easy and relatively inexpensive to install.

Although deeper than dug wells, driven wells are still relatively shallow and have a moderate-to-high risk of contamination from nearby land activities. To minimize this risk, the well cover should be a tight-fitting concrete curb and cap with no cracks and should sit about a foot above the ground. Slope the ground away from the well so that surface water will not pond around the well. If there's a pit above the well, either to hold the pump or to access the fitting, you may also be able to pour a grout sealant along the outside of the well pipe. Protecting the water quality requires that you maintain proper well construction and monitor your activities around the well. It is also important to follow the same land use precautions around the driven well as described under dug wells.

Driven Well



Drilled Well



Drilled Wells

Most drilled wells in Rhode Island penetrate 100-400 feet into the bedrock. Where you find bedrock at the surface, it is commonly called ledge. To serve as a water supply, a drilled well must intersect bedrock fractures containing groundwater.

Hydrofracting A Drilled Well

Hydrofracting is a process that applies water or air under pressure into your well to open up existing fractures near your well and can even create new ones. Often this can increase the yield of your well. This process can be applied to new wells with insufficient yield and to improve the quantity of older wells.

Locating Your Well

Locating your well is the first step to protection. Start by walking around your yard. If you discover a metal pipe, six or eight inches wide, sticking up above the ground's surface and topped with a metal cap, then you have a drilled well. If you find a large cement well cap, about three to five feet in diameter and at the ground's surface, it could be a dug, driven or older drilled well. To determine what's below the cement cap, remove it. If you see an open hole with water standing in it, you have a dug well; if you see a pit with a pipe and/or pump at the bottom of the pit, you have either a driven or older drilled well.

If you've looked and can't find your well or still aren't sure what kind you have, consider enlisting the help of a registered well driller or someone with a metal detector. As a rule, even dug wells contain metal fittings and pipe that can be picked up by a metal detector. It is possible that the original cover of an older well may have become covered over by topsoil and grass or other vegetation in your yard. If this is the case, it is recommended that the well is located and repaired with some additional casing, extending 1 to 2 feet above the ground surface, and properly capped. In some cases, old wells may be located in the basement of your home.

New well construction, repairs to existing wells, and hydrofracting should be completed by a well driller registered with RI DEM. RI DEM regulates the construction of private wells through regulations adopted in 1990. These regulations detail procedures for the siting and construction of new wells, the improvement or abandonment of old wells, and provide for registration of well drillers and pump installers. If your well was constructed after 1990, the RI DEM, Division of Groundwater & Freshwater Wetlands, may have your drilling records on file. As of January 1990, all registered well drillers are required to file well drilling reports with the RI DEM. New well owners should maintain a copy of the well driller's report for their own files.

Six Important Ways to Protect Your Drinking Water Well

1. Proper Location

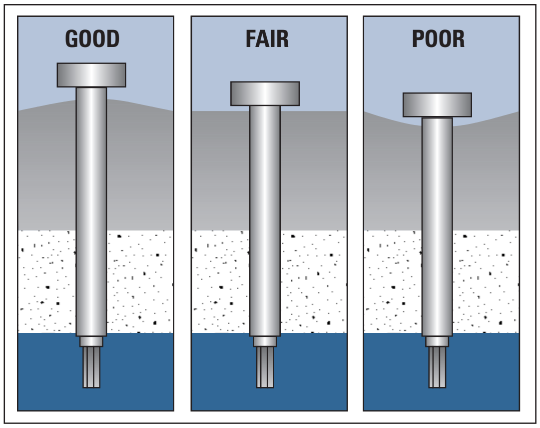
In general, locate a new well as far away from potential contamination sources as possible. RI DEM regulates the distance a private well should be from some potential contamination sources including:

- 75 ft. from septic tank & distribution box
- 100 ft. from septic system drainfield
- 50 ft. from sewer line
- 50 ft. from edge of road surface
- 100 ft. from livestock pens or animal waste storage

2. Proper Construction

Construction of a new well or maintenance of an existing well should be performed by a well driller or pump installer registered with the RI DEM.

- Periodically inspect exposed parts of the well. Look for:
  - Cracks, corrosion, or damaged well casing.
  - Cracked or missing well cap.
  - Settling or cracking of surface seals. When placing your hands on the well, you should not be able to move it.
- Keep accurate records of well maintenance, such as disinfection or sediment removal.
- Every 10 – 15 years have a registered well driller inspect the well for defects.
- Slope the area around the well to drain surface runoff away from the well. Do not allow surface water to pond around the well.



EPA, *Drinking Water From Household Wells,* January 2002

3. Keep Contaminants Away

- Keep potential pollutants as far away as possible from your well.
- Avoid mixing or using pesticides, fertilizers, herbicides, degreasers, fuels, and other pollutants near the well.
- Do not dispose of wastes in dry wells or abandoned wells.
- Inspect your septic system every 1-3 years and pump as needed.
- Never dispose of hazardous materials in the septic system.
- Do not allow runoff from the road, driveway or rooftop to pond around the well.
- Keep the area around the well clear and free of debris.
- Keep pet waste, dog runs and other livestock away from the well.

4. Backflow Prevention

Use backflow prevention devices on all outside faucets with hose connections. This is especially important if you fill pesticide sprayers or other chemical containers. Backflow devices prevent these chemicals from being drawn into the household water supply in the event of a drop in water pressure. You can purchase backflow prevention devices at a hardware store.

5. Sealing Abandoned Wells

Abandoned and unused wells are a potential source of groundwater contamination as they provide a direct

Drilled Well Construction:

• The casing is usually metal or plastic pipe, six inches in diameter that extends into the bedrock to prevent shallow groundwater from entering the well. By law, the casing has to extend at least 18 feet into the ground, with at least five feet extending into the bedrock. The casing should also extend a foot or two above the ground's surface. A sealant, such as cement grout or bentonite clay, should be poured along the outside of the casing to the top of the well. The well is capped to prevent surface water from entering the well.

• Submersible pumps, located near the bottom of the well, are most commonly used in drilled wells. Wells with a shallow water table may feature a jet pump located inside the home. Pumps require special wiring and electrical service. Well pumps should be installed and serviced by a qualified professional registered with the RIDEM.

• Most modern drilled wells incorporate a pitless adapter designed to provide a sanitary seal at the point where the discharge water line leaves the well to enter your home. The device attaches directly to the casing below the frost line and provides a watertight subsurface connection, protecting the well from frost and contamination.

• Older drilled wells may lack some of these sanitary features. The well pipe used was often eight-, 10- or 12- inches in diameter, and covered with a concrete well cap either at or below the ground's surface. This outmoded type of construction does not provide the same degree of protection from surface contamination. Also, older wells may not have a pitless adapter to provide a seal at the point of discharge from the well.

A good practice to follow when drawing water from your tap is to let it run for up to one minute before using it for cooking and drinking.

access or conduit from the ground surface to the groundwater source. They can also be a safety hazard on your property. These wells should be properly sealed when no longer in use. RIDEM's regulations state that wells should be properly abandoned by a registered well driller.

6. Testing Well Water

Test your well annually for nitrates, bacteria, and other constituents of concern. Test whenever you notice a change in taste, color, or odor of your drinking water. For more information see the factsheet *Home Water Testing*.

• • •

For More Information:

This factsheet is one in a series on drinking water wells, testing, protection, common contaminants, and home water treatment methods. Contact the URI Home*A*Syst Program for more information.

University of Rhode Island Cooperative Extension Home*A*Syst Program
Offers assistance, information, and workshops on private well water protection. 401-874-5398 www.uri.edu/ce/wq

RI Department of Health, Office of Drinking Water Quality
Offers assistance, information on testing and state certified laboratories.
401- 222-6867 http://www.health.ri.gov/environment/dwq/Home.htm
For a listing of HEALTH's certified private laboratories in Rhode Island http://www.health.ri.gov/labs/instate.htm

US EPA New England website: http://www.epa.gov/ne/eco/drinkwater/

US Environmental Protection Agency. For a complete list of primary and secondary drinking water standards: http://www.epa.gov/safewater

RI Department of Environmental Management, Office of Water Resources
Maintains listing of registered well drillers, information on well location and construction.
401-222-4700 http://www.state.ri.us/dem/programs/benviron/water/permits/privwell/index.htm

NSF International
For information on water treatment systems, NSF International has tested and certified treatment systems since 1965.
800-NSF-MARK http://www.nsf.org/water.html

Water Quality Association
The Water Quality Association is a not-for-profit international trade association representing the household, commercial, industrial, and small community water treatment industry. For information on water quality contaminants and treatment systems. www.wqa.org

This project is a collaboration of the staff at HEALTH and the University of Rhode Island Cooperative Extension Water Quality Program.

This project is a collaboration of the staff at the Rhode Island Department of Health: Richard Amirault, Gary Chobanian P.E., Dana McCants, and the University of Rhode Island Cooperative Extension Water Quality Program: Alyson McCann, Holly Burdett, Brianne Neptin.

Issued in furtherance of Cooperative Extension work and Acts of May 8 and June 30, 1914. Jeffrey Seemann, Dean and Director, College of the Environment and Life Sciences. The University of Rhode Island U.S. Department of Agriculture, and local governments cooperating. Cooperative Extension in Rhode Island provides equal opportunities in programs and employment without regard to race, sex, color, national origin, sex, or preference, creed or disability. This is contribution number 3969 of the College of the Environment and Life Sciences, University of Rhode Island.

Funding for this project is supported by HEALTH.

Rhode Island Department of HEALTH

UNIVERSITY OF Rhode Island

Water Quality Protection

SAFE AND HEALTHY LIVES
IN SAFE AND HEALTHY
COMMUNITIES

Rhode Island Department of HEALTH

UNIVERSITY OF Rhode Island

Residential Series
March 2004

Water Conservation In and Around The Home

RHODE ISLAND IS A STATE RICH IN WATER RESOURCES. From our freshwater lakes and ponds, rivers and streams, and abundant groundwater resources to our coastal ponds, estuaries, Narragansett Bay, and the Atlantic Ocean, our water resources sustain our livelihood. Our land use activities affect the quality of these water resources. There are many things that each of us can do to protect water resources. In this factsheet, we focus on Water Conservation In and Around The Home.

When we turn on the faucet, most of us take for granted an unlimited flow of inexpensive, drinkable water. Increasingly, however, we have been placing strains on our water supplies. Increased development, population growth, water contamination, and drought conditions affect the quality and quantity of our drinking water. Each Rhode Islander uses approximately 50-75 gallons of water a day. The problem is not what we use water for, but how we use water. Frequently, we use more water for household tasks than we need; the largest amount is used in the bathroom.

Clean water is a limited resource we must conserve. Only a small fraction of the earth's fresh water is available for our use; the rest is frozen in glaciers or ice caps or is too polluted for us to use. Conserving water does not necessarily mean going without. Conservation is simply the wise and efficient use of a limited, natural resource. Conserving water saves money and energy, and helps reduce water pollution. Water conservation can have positive impacts on the financial and environmental resources of a community and provide an alternative approach to developing new water supply sources.

Why Conserve Water?

Water Conservation Saves Money
If you receive drinking water from a public water supply system, the cost of treating, pumping, and delivering this water continually increases; as does the cost of treating the wastewater that leaves your home. In most urban areas of the state, sewer bills are directly tied to water use. Reducing the amount of household water you use can mean substantial savings on water, sewage, and energy bills.

If you have a private well and septic system, conserving water will also save you money. The reduction in the use of your water pump may reduce costly repairs. In addition, reducing the amount of wastewater generated can help prolong the life of your septic system.

Water Conservation Saves Energy
Significant quantities of energy are used to pump, heat, and treat water used in your home. Reducing water use can save energy and reduce your monthly bills. For example, running the tap until the water gets warm wastes both water and energy; insulating your hot

water pipes is one solution. Another solution is collecting the cooler water from the shower in a bucket while you wait for the water to warm. Use the collected water for plants.

Water Conservation Reduces Pollution

Conservation reduces wastewater entering sewage treatment plants. Often this means better treatment and ultimately, cleaner water being discharged to our rivers and bays. Water conservation also prevents wastewater overloads to on-site septic systems, ensuring proper functioning and treatment of domestic wastewater. Outdoor water conservation and proper irrigation of lawns and gardens reduces pollution from recently applied fertilizers, pesticides, and unmanaged pet waste.

Water Conservation Helps to Reduce Effects of Drought

Droughts are a period of abnormally dry weather that persist long enough to produce a water imbalance that effects crop production, water supplies, and water needs in the natural environment. During a drought period that lasts long enough, drinking water wells may go dry and public water supplies may issue water use restrictions. Adopting water conservation practices limits water withdrawals and use, reducing the overall water deficit that occurs during a drought.

Water Conservation Reduces Risk of Saltwater Intrusion

In places where salt and fresh water meet, saltwater commonly extends inland some distance beneath the coastal land surface. Fresh water, which is less dense, floats on top of the saltwater. When a well is located near the coast and near the boundary between the fresh water lens and saltwater, saltwater intrusion can occur. This happens when the fresh water level is reduced by excessive well pumping and lack of groundwater recharge (usually during hot, dry periods) allowing the saltwater to infiltrate further beneath the coastal land surface. A pumping well may then begin to withdraw this saltwater. This could be a problem for drinking water wells located near the immediate coastline and coastal salt ponds.

What can you do?

There are many things that each of us can do to conserve water. Some of these things require changing habits, while others may require an investment in relatively inexpensive equipment. Water consumption can be reduced by 20 to 40 percent without purchasing expensive equipment or being inconvenienced.

- Check for leaks in faucets, toilets, hoses, and pipes. A steady drip can waste up to 20 gallons a day, amounting to over 7,000 gallons per year!
- If you are on public water you can check for leaks by turning off everything in the house that uses water. Record the reading on your water meter. After an hour, recheck the meter. If the meter reading has changed, you have a leak. Repairing a leaky faucet can be as simple as changing a washer.
- A leaking toilet can waste hundreds of gallons of water a day without making a sound. To check the toilet, put enough food coloring into the tank to color the water. If, without flushing, the color appears in the bowl, you have a leak. Adjusting or replacing the float arm of the plunger ball often repairs leaky toilets.
- Install water conservation fixtures and appliances. Conventional fixtures and appliances require more water than necessary under normal pressure. Simply retrofitting existing devices or replacing conventional showerheads, toilets, and washing machines with modern, conservation models can save many gallons. A flow reducer placed in the water pipe, a low-flow fixture, or an attachment to the existing fixture all can reduce water use.
- Install an aerator on each household faucet. These inexpensive devices are available at hardware stores and result in substantial water savings.
- Install low-flow showerheads to reduce flow by 50 to 75%. These can be purchased for about $10 and quickly pay for themselves in water savings.
- Install a low-flow toilet when making renovations. Some use as little as 1.6 gallons per flush, while conventional toilets use 5-7 gallons per flush. Pressurized toilets are excellent water conservation devices. In fact, a state law requires the installation of 1.6-gallon toilets and other water-saving fixtures in all new construction and renovations in state-owned buildings.
- Many public water suppliers have water conservation kits available.
- Change your water use habits. The following ideas can save water in the bathroom, kitchen, laundry, and outdoors.

Bathroom

We use more than half of our daily water use in the bathroom. Unrestricted showerheads run at 5 to 10 gallons a minute, meaning a five-minute shower can use 25 to 50 gallons of water. A bath can use as much as 60 gallons of water. Here are some simple practices that can greatly reduce water use in the bathroom.

Showering

- Avoid running water in the shower while you are shampooing or soaping. Most people step away from the water to do this anyway. Many water-saving showerheads come with a button to shut off the flow without changing the mix of hot and cold water.
- Take shorter showers instead of baths. With a low-flow shower-head, a four-minute shower can use as little as 8 gallons of water, while a bath uses 50-60 gallons.

Toilets

- Do not use toilets as ashtrays or trash receptacles. Each unnecessary flush wastes 1.6 -7 gallons depending on the kind of toilet.
- Do not dump household hazardous wastes down your toilets or drains. Learn to recognize which household products are hazardous.

Washing

- Turn water off while brushing teeth, shaving, and washing.

Kitchen and Laundry

We use a lot of water to cook and prepare food, wash dishes and clothing, and clean. A normal faucet without a flow aerator runs at the rate of 3 to 5 gallons a minute. Normal dishwasher loads require at least 15 gallons of water. Each load of laundry normally requires about 50 gallons or more of water. Some simple practices can greatly reduce the amount of water used each day. Additionally, if you're buying new appliances, consider purchasing water conservation models. These may cost more in the beginning, but will save you money in the long run.

Food preparation

- Wash fruits and vegetables in a bowl of water rather than running the faucet. When done, use the water for plants.

Dishwashing

- When washing dishes by hand, instead of running water continuously, use one basin for washing and another for rinsing.
- When washing dishes by hand, use the least amount of detergent possible to avoid having to rinse continuously.
- Run the dishwasher only when full. If you're buying a new dishwasher, consider one that uses less water.

Waste disposal

- Compost your food scraps rather than use the garbage disposal. Disposals use a great deal of water and add unnecessary solids to the sewer or septic system.

Water storage

- Keep a bottle of drinking water in the refrigerator, instead of running the faucet until the water is cold.

Clothes washing

- Use your washing machine only when full.
- If you are purchasing a new washing machine, consider a suds-saver model that reuses water for a second load or another model that uses less water. You could reduce your water use from as much as 60 gallons to 20 gallons.

Outside

Hundreds of gallons of water may be used outside on any particular day as people water their lawns and gardens. It takes 625 gallons to water 1000 square feet of lawn with 1 inch of water. For this amount of water, you could do 12 loads of laundry, or take 25 showers, or provide 10,000 glasses of water.

- Slow, deep waterings are more beneficial for plants. Plants can only absorb so much water at a given time; likewise, the soil within the plant root zone can only store so much water at a given time. Over-watering wastes water, increases the risk of pollution, and can weaken plants and encourage disease.
- Always abide by any outdoor water use restrictions that your local water utility may have. For more information on water conservation in the home landscape, see our website, www.healthylandscapes.org or contact us at (401) 874-5398.

Lawns

- Keep your grass 2-3 inches high. Taller grass retains more moisture.
- Lawns require one inch of water per week to remain actively growing. Measure weekly rainfall and apply only the amount of water needed to make up the difference. Another option is to allow your lawn to go dormant during the hot, dry summer months. Your lawn may turn brown in the middle of the summer but this doesn't mean that the grass is dead. Dormant grass will re-grow when rain and cooler weather return.
- Apply water during the cool parts of the day, preferably in the morning, to prevent excess evaporation.

Gardens

- Use a drip irrigation system in your garden. This system supplies water directly to the individual plant root zones. In addition to saving water, it reduces weeds because it doesn't water the areas between the rows and plots.
- When landscaping your yard, select sustainable plants that have low requirements for water, fertilizers, and pesticides. Consider planting native plant materials. The URI GreenShare Program's Sustainable Trees and Shrubs Manual lists suggestions.
- Form ditches or basins around plants to allow water to pond and seep in slowly and to prevent runoff.
- Mulch landscaped and garden areas to reduce evaporation.
- Don't use sprinklers and hoses for play.
- Use low-pressure, perforated hoses for watering shrubs and gardens rather than sprinklers.
- Install a rain barrel under roof downspouts to catch water flowing off the roof and re-use in the garden.

Car washing

- Don't leave the water running while washing your car. Allow the washwater to drain onto the lawn or garden instead of down the driveway or stormdrain.

Clean up

- Use a broom instead of a hose to clean sidewalks, driveways, and patios.
- You can reduce your water use without sacrificing cleanliness or interfering with your lifestyle. Encourage others to do the same.
- Get involved in water conservation projects in your community and place of work.

• • •

For More Information:

University of Rhode Island Cooperative Extension Home*A*Syst Program

Offers assistance, information, and workshops on residential pollution prevention including private well water protection, septic system operation and maintenance, landscaping for water quality protection, and actions residents can take to reduce pollution.

401-874-5398 www.uri.edu/ce/wq

Refer to our website www.healthylandscapes.org for more information on sustainable landscaping and stormwater runoff control.

RI Department of Health, Office of Drinking Water Quality

Refer to our website www.healthylandscapes.org for more information on sustainable landscaping and stormwater runoff control.

Offers assistance and information on private well water testing and state certified water testing laboratories.

401- 222-6867 http://www.health.ri.gov/environment/dwq/Home.htm

For a listing of HEALTH's certified private laboratories in Rhode Island http://www.health.ri.gov/labs/instate.htm

URI CE GreenShare Program

(401) 874-2900

www.uri.edu/ce/ceec

The GreenShare Program provides scientifically accurate and environmentally sound information on management of suburban and urban landscapes. Integrated pest management, pollution prevention and sustainable landscaping are the guiding principles of all GreenShare programs. The Sustainable Trees and Shrubs publication is available on-line at: http://www.uri.edu/ce/factsheets/sheets/sustplant.html

This project is a collaboration of the staff at the Rhode Island Department of Health: Dana McCants, Clay Commons, and the University of Rhode Island Cooperative Extension Water Quality Program: Alyson McCann, Holly Burdett, Brianne Neptin. Issued in furtherance of Cooperative Extension work and Acts of May 8 and June 30, 1914. Jeffrey Seemann, Dean and Director, College of the Environment and Life Sciences. The University of Rhode Island U.S. Department of Agriculture, and local governments cooperating. Cooperative Extension in Rhode Island provides equal opportunities in programs and employment without regard to race, sex, color, national origin, sex, or preference, creed or disability. This is contribution number 4000 of the College of the Environment and Life Sciences, University of Rhode Island.

Funding for this project is supported by HEALTH.

This project is a collaboration of the staff at HEALTH and the University of Rhode Island Cooperative Extension Water Quality Program.

Rhode Island Department of HEALTH

UNIVERSITY OF Rhode Island