NUMBER 28
Fall 2012

Massachusetts Department
of Conservation and Recreation
Division of Water Supply Protection
www.mass.gov/dcr/watersupply.htm

Stormwater Management

Key to pollution prevention

By Kelley Freda, DCR Environmental Analyst

There are many federal, state and municipal laws that are designed to protect water quality. The concept behind them all is relatively simple: water, and everything it picks up, flows downhill to the nearest water body.

When rain falls and cannot soak into the ground, it flows over driveways, roads, and rooftops, collecting anything in its way before ending up in surface waters, either directly or through a storm drain system. This pollutant pathway is called stormwater runoff. Most storm drains in the Wachusett Reservoir watershed empty directly into rivers or streams which then flow into the reservoir. There is no treatment with these storm drains – what goes in the drain comes out in the surface waters!

In a perfect world, rain and stormwater runoff would have time to soak into the ground and be cleansed by plants and trees that take up nutrients and other pollutants from soils and water through their roots, transforming pollutants into less harmful substances. In fact, DCR's Land Acquisition and Land Management Programs strive to meet that goal (see *Downstream* #27 and #18) on critical lands throughout the watershed. However, as impervious surfaces such as driveways, roads, parking lots and rooftops, continue to be built on developable property, we cannot rely on stormwater being cleaned by natural means.

Have you ever watched the rain during a heavy storm as it is flows along road shoulders or down gutters? The sides of the road are behaving as a stream. You can see it carrying trash, cigarette butts, and debris. You can't see it carrying bacteria and nutrients that will have an effect on nearby water quality and wildlife.

Take a peek into a storm drain during a dry time and you might be surprised at what you see in there – an assortment of leaves, dirt, and garbage collected by the stormwater's travels. Now imagine a stormwater system that has a hundred connected drains, and everything that you see emptying into a stream at the same time through one pipe during the next storm. It's not the one storm drain and associated pollutants that are a problem – it's the hundreds connected together that can be found in every community that makes stormwater runoff a serious issue.

Continued on Page 4

The Pest from the West

Help stop the spread of the Spiny Water Flea

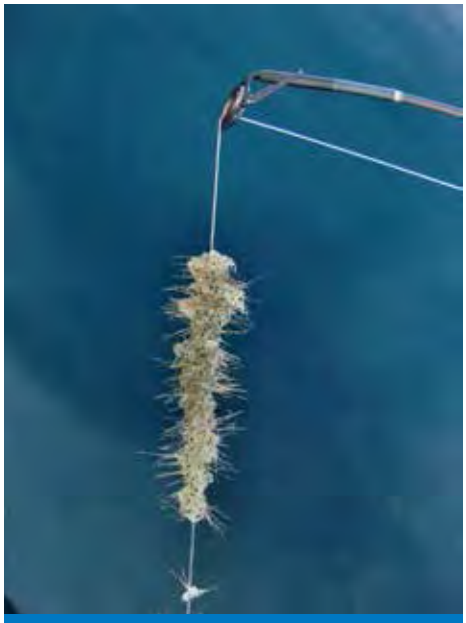
By Paula Packard, DCR/DWSP Aquatic Biologist

The Spiny Water Flea (SWF), native to northern Europe and Asia, was introduced into the United States sometime before 1984 in the ballast water of ships. SWF were approaching New England when *Downstream* first reported on this topic in the Spring 2009 issue. In August 2012, they were detected in the Champlain canal. Efforts are underway to prevent their spread to Lake Champlain, but it is unlikely that this will be successful.

The Quabbin Boat Decontamination program that is currently in place helps to protect the reservoir from a SWF infestation. Many fishermen and boaters, however, travel between places that have, or could have, SWF and the Quabbin and Ware River watersheds. There is no mandatory decontamination program for the entire watershed system, so the threat of SWF being introduced to one of the watershed system's lakes or ponds is increasing as this organism becomes established closer to Massachusetts.

Spiny Water Fleas on an adult thumb and under a microscope.

Spiny Water Fleas, with their long barbed tail, measure about 3/10 of an inch, are unpalatable for some fish, compete with small fish for the same food, foul fishing gear and other equipment, and alter numbers and types of microscopic life in a water body. They are transported on boats, equipment, and tackle, in bilge water, bait buckets or by wildlife. SWF sometimes reproduce by forming a resting egg stage that is really tough. Some studies show that resting eggs may be viable after passing through the gut of a bird, potentially enabling the distribution of eggs for long distances. Females can reproduce parthenogenically, which means without a male, so a single female could begin a new infestation.



Spiny Water Fleas can foul fishing gear, like this massing together on fishing line.

If you travel to a water body that has Spiny Water Fleas, please be aware that you may be transporting this nasty invasive to another place. DCR asks that you wash boats, gear and equipment with water heated to over 104° F. If washing is not feasible, dry any object that has been in contact with the water for a minimum of five days – the longer the better to kill both the adult SWF and the resting egg stage.

Spiny water fleas prefer the deep, cold, clear water found in larger lakes like the Quabbin and Wachusett Reservoirs, where it has not yet been detected. Once in a water body, there is no method currently available to get rid of it!

Prevention is the key to keeping Spiny Water Flea out of Quabbin and Wachusett Reservoirs!

In This Issue:

Stormwater Management 1
Key to controlling water pollution culprit

Pest from the West 2
The Spiny Water Flea is a constant threat

Pondering the Ponds 3
Monitoring watershed lakes and ponds

Reservoir Watch 3
Reservoir statistics at a glance

Kids Corner 7
An amazing stormwater journey

Then and Now 8
Quabbin Reservoir baffle dams

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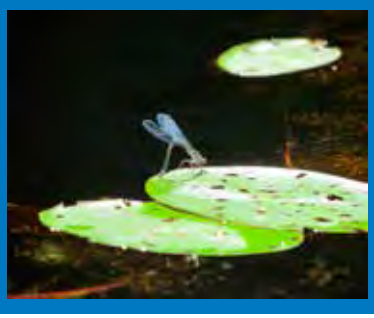
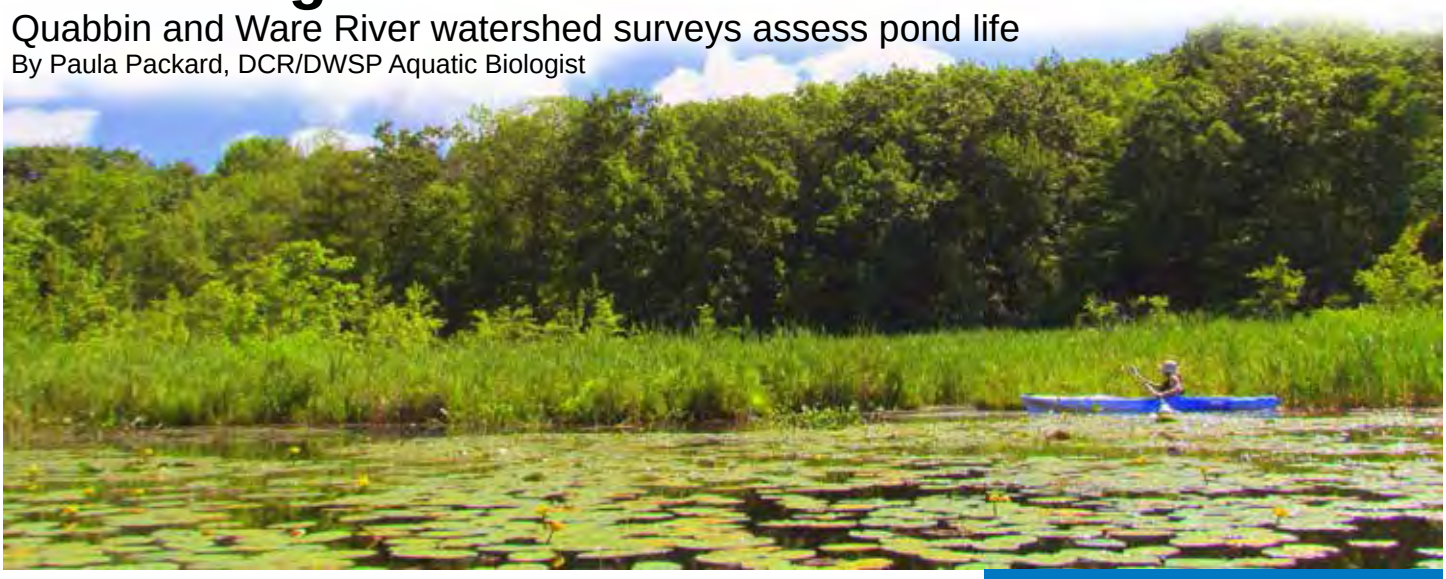


Pondering the Ponds

Quabbin and Ware River watershed surveys assess pond life

By Paula Packard, DCR/DWSP Aquatic Biologist



Aquatic Biologist Paula Packard investigating pond life.

The Quabbin Reservoir and Ware River watersheds cover approximately 180,000 acres, or 281 square miles. There are many ponds and lakes within this vast area that are used for fishing, boating, swimming and other types of recreation as well providing habitat for wildlife. As people and animals travel long distances between water bodies, the risk increases of inadvertently introducing an unwanted "hitchhiker" into a new environment. If one water body has an Aquatic Invasive Species (AIS), it may be carried to another pond nearby. This is especially worrisome if the AIS becomes established in a water body that is either in close proximity to, or flows directly into, the reservoir.

Aquatic Invasive Species (AIS)

AIS compete with native species, reduce biodiversity, have little food value, and may affect fishing, boating, and ultimately water quality, so it is important that DCR closely looks at local water bodies on an annual basis. Pond surveys, focusing mainly on plants, are conducted to determine both the native and non-native aquatic species growing in that location. The presence of any invasive species is documented, taking note of its relative abundance. Some AIS, such as Curly Pond Weed, are most productive early in the growing season, therefore a pond that was surveyed late in the growing season one year is checked early in the growing season the next year to reduce the risk of missing a particular plant.

Ponds Surveyed

The DCR Pond Survey Program began in 2010, but was not in full effect until 2011 when 25 ponds were inspected covering approximately 56 miles of shoreline. This year, 27 water bodies were surveyed, covering about 59 miles of shoreline. The ownership of the ponds varies: some are private, some are controlled by DCR, and some are part DCR and part private land.

Continued on Page 6

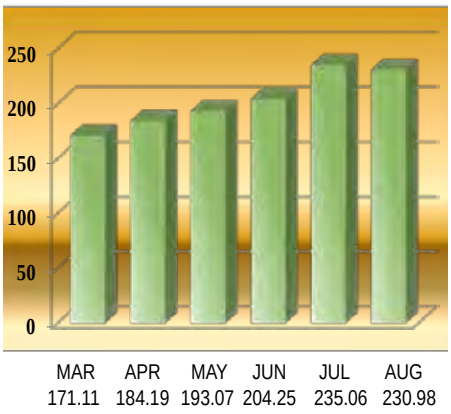
A painted turtle watches intently as it is counted in DCR's pond survey.

Reservoir Watch

Reservoir levels and 6-month precipitation

Reservoir	Quabbin	Wachusett
Minimum	524.93'	390.17'
% Full	90.6%	90.4%
Date	8/31/12	8/31/12
Maximum	529.01'	391.34'
% Full	98.1%	92.7%
Date	3/1/12	3/12/12
Precipitation	17.98"	24.0"
Seasonal Avg	25.06"	23.4"

System-wide 6-month Water Usage (in million gallons per day) March to August 2012



Storm Water

from Page 1

What is in stormwater runoff and what are its effects?

Stormwater runoff carries sediments, nutrients, pathogens and bacteria, toxic contaminants, debris, and while not an actual pollutant, an impact called thermal stress.

Sediments – sand, soil, and silt – causes turbidity or cloudiness in streams. Sediments can clog the gills of fish and other aquatic organisms. When sediments settle out of the water, it can change the composition of the stream bottom, reducing the ability for plants to grow and disrupting rocky bottom fish habitat. According to the EPA, sediment is one of the top causes of surface water pollution in the United States.

Sediment suspended in stormwater runoff enters a stream.

Nutrients such as nitrogen and phosphorus come from fertilizers as well as human and pet waste. Too many nutrients can cause algal blooms, which pose problems for drinking water suppliers by clogging screens and creating taste and odor complaints. Blooms involving toxin-producing species can pose serious threats to animals and humans.

Pathogens and bacteria that come from human, pet, and wildlife waste can cause a long list of health problems and force swimming beaches to close. Stormwater runoff picks up toxic contaminants when automobile fluids are left on the ground, hazardous materials are not stored properly, and pesticides and herbicides are not applied according to directions. Grass clippings, leaves, and plant trimmings can take oxygen out of the water, and they also contain nutrients including nitrogen and phosphorus. Low levels of dissolved oxygen can kill fish – most often the species sought after by fishermen. Trash such as coffee and bait cups, bottles, food wrappers, and plastic bags not only looks unsightly but can also seriously harm wildlife and aquatic organisms.

If you have ever walked across pavement on a hot sunny day barefoot, then you know how much heat hardtop absorbs. When a cold or cool rain washes over hot pavement, the rainwater heats up dramatically before flowing into water bodies and raises the temperature of the receiving stream or lake. Sudden changes in water temperatures impacts water quality and chemistry, and can affect fish and other organisms. This is the same concept, just on a much larger level, as pouring hot water into a home aquarium.

MS4 Program

The National Clean Water Act (CWA) was signed into law on October 18, 1972. The CWA, administered by the US Enviromental Protection Agency, protects water quality by curbing municipal and industrial wastewater discharges, managing biosolids from sewage treatment plants, controlling polluted runoff from urban and rural areas, and preventing habitat destruction. There are programs for both point source (hazards that can be traced back to one source or pipe) and non-point source (from diffuse places) pollution. The CWA's National Pollution Discharge Elimination System (NPDES) program requires all facilities that discharge pollutants from any point source into waters of the United States to obtain a NPDES permit.

Forty years after the passage of the CWA, the EPA has found that stormwater runoff makes up most of the pollution in rivers and streams

An algal bloom caused by stormwater runoff's excessive nutrients.

today. The storm drain systems in most urban and suburban communities are considered a point source discharge and are therefore regulated under NPDES through the Municipal Separate Storm Sewer System (MS4) program, which requires a federal permit. Fifteen municipalities within the DCR/MWRA water supply system fall under this program, including Boylston, Clinton, Holden, Leominster, Rutland, Sterling, West Boylston, Westminster, and Worcester.

A MS4 permit issued by EPA gives the city or town approval to discharge stormwater into waterways with the understanding that only clean stormwater will enter the surface waters. The municipality is then responsible for ensuring that nothing enters the system that can pollute the community's lakes, rivers, and streams. EPA can issue fines to the town for violations or noncompliance with the permit.

What You Can Do to Improve the Quality of Stormwater

DCR has been actively constructing stormwater structures, such as detention basins, raingardens, swales, and channels, in an effort to remove pollutants from state property and public roadways runoff before it reaches the Wachusett Reservoir. Everyone's help, however, is needed to make a difference. Following the simple steps listed on page 5 will help keep your community's streams, rivers, lakes, ponds, and reservoirs clean.

Stormwater Spotlight:
Wachusett Reservoir Direct Discharge Removal Project

DCR has constructed several Best Management Practice Structures (BMPs), such as detention basins and rain gardens, as a key component to its non-point source stormwater management control strategy. There are also efforts to remove direct discharges from storm drain systems that enter Wachusett Reservoir along the main roads that circle the reservoir. Several areas were identified for remediation; priority was ranked by proximity to the Cosgrove Intake, reservoir dynamics, prevailing winds, and site characteristics.

The first phase of this project focused on the area along Route 70 from Mile Hill Road in Boylston to the intersection of River Road below the Wachusett Dam in Clinton. Five discharge pipes were located within this 2.1 miles of road. DCR paid $190,000 in 2009 for the design of a new layout and drainage system, which was estimated to cost $2.3 million. DCR collaborated with the state Department of Transportation for the construction. DOT completed the work on-time in 2012, 20% under budget at a total cost of $1.9 million.

The new installed road drainage consists of both "closed" systems – catch basins with piping that takes the run-off to an area that is off the watershed – and "country" designs comprised of grass shoulders and drainage swales. These drainage improvements have removed all roadway runoff, and the contaminants picked up by stormwater, from directly entering into the Wachusett Reservoir. The new drainage infrastructure also removes the threat from hazardous materials entering the reservoir from vehicle accidents on this stretch of Route 70.

Improvements have been recommended for other critical areas around the reservoir, including the Route 12 Causeway, Beaman Street Bridge, and approximately 2,500 feet of Route 140 bordering South Bay (which includes 23 pipe discharge locations). The Division remains committed to removing these threats from the drinking water supply. Engineering design services for the Route 12 Causeway BMPs will be developed and bid in Fiscal Year 2013.

Wachusett Reservoir direct discharges (red dots) replaced by BMPs (blue dots), like this detention basin next to the Clinton courthouse (below; Letter B circled above).

Here are some easy steps you can take to help your town comply with the requirements of its stormwater permit. These acts will also assist in DCR's management of the source water supply for over 2 million Massachusetts residents.

- ✓ ***NEVER DUMP ANYTHING DOWN A STORM DRAIN!***
- ✓ Sweep sand on a regular basis and keep it away from storm drains or road shoulders.
- ✓ Wash vehicles on a lawn or take them to a commercial car wash.
- ✓ Perform any vehicle or equipment maintenance indoors or on a paved surface. Soak up and clean any spills immediately. Fix auto leaks as soon as possible.
- ✓ Store any hazardous materials, including pool chemicals, properly. Keep hazardous materials out of the rain.
- ✓ Keep grass clippings, leaves, and brush away from storm drains and gutters.
- ✓ Use fertilizers, pesticides, and herbicides sparingly. Never apply before heavy rain is forecast. Apply only as directed on the label.
- ✓ Pick up after your pets – on public property and in your own yard.
- ✓ Inspect your septic system regularly.
- ✓ Vegetate or seed any areas in your yard where soil is exposed.
- ✓ Use salt and sand sparingly during the winter months and sweep it up as soon as it is possible.
- ✓ Construct a raingarden on your property. Information can be found at www.mass.gov/dfwele/der/riverways/pdf/raingardenfactsheet.pdf.
- ✓ Be aware of any stormwater structures on your property, such as detention basins or swales, and keep them maintained.

Pond Surveys from Page 3

A Great Blue Heron enjoys a fish found in the shallow water.

In most cases, kayaks were used to inspect the perimeter of each pond or lake. Variable Water Milfoil, Fanwort, and Phragmites are the invasive plants that have been found in one or more water bodies within the watershed. DCR is concerned about the introduction of other invasive plants as well as some potentially harmful organisms, including Spiny Water Flea, Asian Clams, and Didymo; to date, none of these species have been found in any of the study area's lakes or ponds.

Interesting Native Inhabitants

There are a wide variety of native species that thrive in the Quabbin and Ware River watersheds.

It is common knowledge that sponges come from the ocean, but did you know that there are freshwater sponges in the DCR watersheds? These species are usually found coating branches that have fallen into the water and can range in color from a drab beige to brilliant green.

Bryozoans are single celled organisms that filter organic particles out of the water. Bryozoans form colonies that can grow as large as a soccer ball and are common throughout the watershed.

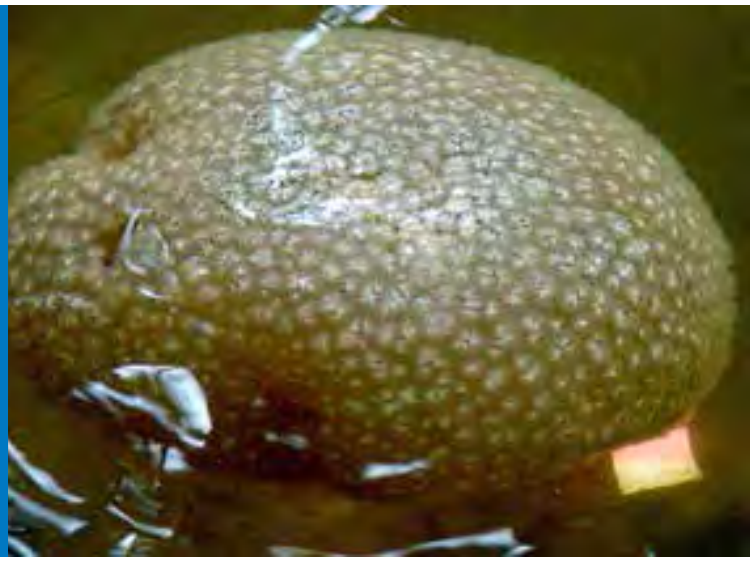
In many of the more boggy water bodies, small, delicate, carnivorous plants called Sundew can often be found among the also carnivorous, but somewhat larger, Pitcher Plants.

In the same type of habitat, Horned Bladderwort may be found in bloom early in the growing season. This plant bears a single flower on a delicate stem with no visible leaves at all.

If you are quick enough to catch the elusive musk turtle, also known as a stinkpot, you will realize how it acquired that nickname! When nervous, this small turtle releases a lasting, strong smelling substance. Painted turtles and large snapping turtles can also be observed if you sit quietly.

These are but a few of the interesting native species found in local ponds and lakes and one of the reasons DCR strives to keep the Quabbin Reservoir and Ware River Watersheds free from AIS.

If you would like a list of surveyed ponds or information on the program's findings, please contact Paula Packard at 413-323-6921 ext. 302 or by email at paula.packard@state.ma.us.



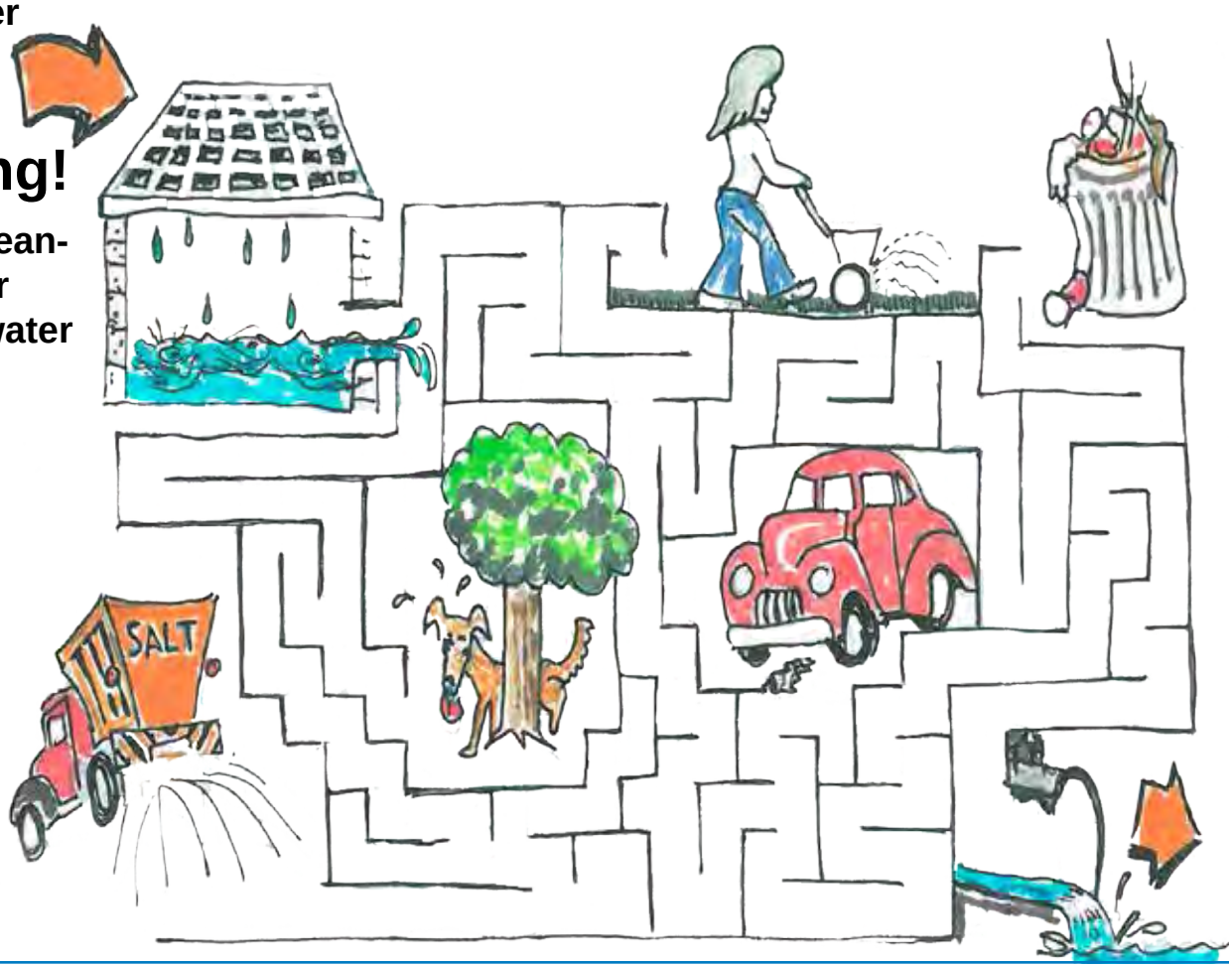
A bright green fresh water sponge (left) is a native of the Ware River watershed. A Bryozoan colony (right) forms a large and delicate ball that can be found attached to submerged sticks. Both sponges and bryonzans have fresh and salt water species.

Kids Corner

Amazing!

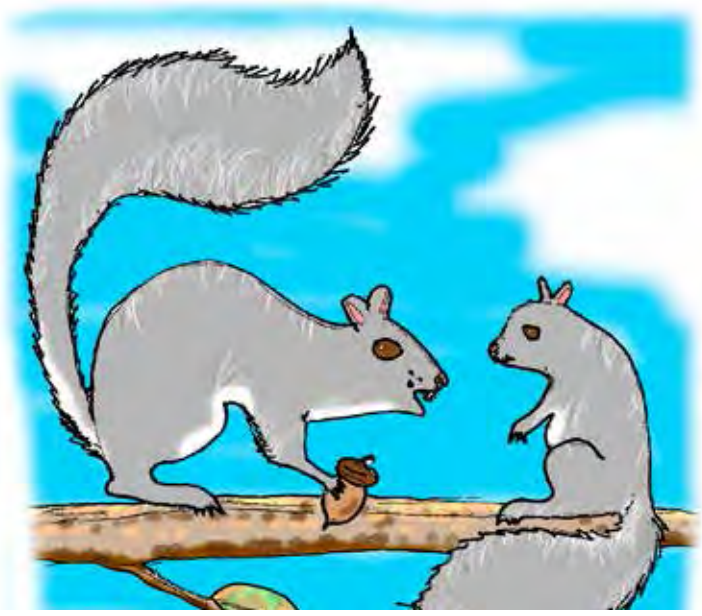
Find the cleanest path for the stormwater flow.

By J. Taylor



And another thing...

By J. Taylor



"Whaddya mean you don't eat nuts?"

For more information about Stormwater Management

DCR Stormwater Brochures
www.mass.gov/dcr/watersupply/watershed/dwmfactsheets.htm

US Environmental Protection Agency
http://cfpub.epa.gov/npdes/home.cfm?program_id=6

NPDES MS4 Permits in Massachusetts
www.epa.gov/region1/npdes/stormwater/ma.html

For more information about Spiny Water Flea and Other Aquatic Invasive Species

DCR Office of Watershed Management
www.mass.gov/dcr/watersupply/watershed/spinywaterflea.htm

DCR Lakes and Pond Program
www.mass.gov/dcr/watersupply/lakepond/invasive_1.htm

Aquatic Nuisance Species Task Force
http://anstaskforce.gov

Quabbin Reservoir Baffle Dams

By Clif Read, Quabbin Visitor Center Program Coordinator

At left is the construction of the Baffle Dams in 1937. At right is the same location today.

One of Quabbin's most interesting but often misunderstood features are two baffle dams located in the Hardwick and Petersham area of the reservoir. Built in 1936-1937, the two dams, oriented north to south, connect the mainland to two islands. The south dam, the smaller of the two, is 565 feet in length, with a width of 130 feet at its base, to 15 feet along its top. The larger, northern dam is about a third of a mile long with a width of 420 feet at its base, tapering to 15 feet at the top. Its northern end lies above the site of the former Greenwich Village, which was along the East Branch of the Swift River. The dam rises to a height of 95 feet above the valley floor in this location, while the south dam's maximum elevation is only 32 feet above the reservoir bottom. Over 550,000 cubic yards of soil and rock were used in the construction of these dams, much of it quarried from Den Hill, the island just east of the north baffle dam. The exposed rock scar is still visible today poking up above the water line of Den Hill's western slope.

The dams deflect water entering the reservoir directly from the East Branch of the Swift River as well as the Ware River via the Quabbin Aqueduct. By redirecting waters in a northerly, counterclockwise direction around the baffle dams, Mt. Zion Island, and other smaller islands, water residence time in the reservoir increases to almost three years! This length of time aids the reservoir's natural purification processes by promoting greater settling of sediment and organic materials before the water enters the drinking water distribution system.

downstream

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Downstream is produced twice a year by the Massachusetts Department of Conservation and Recreation, Division of Water Supply Protection. It includes articles of interest to the Watershed System communities. Our goal is to inform the public about watershed protection issues and activities, provide a conduit for public input and promote environmentally responsible land management practices.

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