

# What's Beneath the Surface?

A Study Guide to complement

## *Beneath the Surface*

A Circus of Wonderments that asks BIG! questions about water quality

### Episode 2: Invigorate the Common Well

By **In the Heart of the Beast Puppet & Mask Theatre and Center on the Commons**

**In the Heart of the Beast Puppet and Mask Theatre** has been using water, flour, newspaper, paint and imagination to tell stories that explore and celebrate the human experience and the wonders of the natural world since 1974. Each year we produce a season of original company-generated plays for both family and adult audiences. We also produce the MayDay Parade and Festival each spring to welcome the return of the sun to our northern skies. In addition we teach puppetry and pageantry to students and teachers, teenagers and youth, and community members in our neighborhood and throughout Minnesota. We find that theater brings people together. It builds community. It is with great respect and awe that we see the power and joy of this ancient art form flourish in unsuspecting ways and places.

**On the Commons** (Formerly Tomales Bay Institute) is developing the commons as a new model of politics, economics and culture. Our work is rooted in the belief that many forms of wealth -- nature, knowledge, public institutions -- belong to us all. The Institute encourages new policies, public understanding and community-based strategies to protect and extend this common wealth. Begun in 2001, our national network of fellows and allies is connected online via [www.onthecommons.org](http://www.onthecommons.org)

On the Commons began a collaboration with In the Heart of the Beast Puppet and Mask Theatre in the summer of 2006. TBI sees involvement with Invigorate the Common Well as a unique opportunity to better understand how to create vehicles for making the commons tangible, concrete and visible to the general public and we seek to encourage deeper public knowledge and interest in the significance of the commons in all of our lives.

This study guide was written by Rachel Breen, with On the Commons and D. Blake Love, an intern with HOBOT through a program of the University of Minnesota's Center for Urban and Regional Affairs (CURA).

Dear Teacher:

Welcome to water. Water is in us, above us, below us and all around us. Water is essential for all life. Water is a commons, an inheritance from our ancestors and a gift we are responsible for safeguarding and passing on to future generations. In Episode II of *Invigorate the Common Well*, *Beneath the Surface*, we celebrate and explore the quality of the water we drink every day.

Three episodes of *Invigorate the Common Well* accompany the restoration of the drinking fountain in the lobby of In the Heart of the Beast Puppet and Mask Theatre. The first episode, *Come to the Well*, was held in March of 2007 and focused on issues of water quantity and privatization. The third episode will be held July 26 2008 and will celebrate the rededication of the new drinking fountain with a full day of activities celebrating water.

Our current episode, *Beneath the Surface* turns our attention towards the complex geological and human systems that bring water to our thirst. How little we think of water in our daily life, yet our city is named the “City of Water”! From our water-rich city, the tangible pipes of our fountain connect us to the thickly complex global and local issues of quantity, quality and “ownership” of water around the world. But how are we connected to these issues, and what must we do?

This study guide covers the basic topics performed in *Beneath the Surface*. The guide is divided into sections according to the show topics. Each section has background information about the topic, possible discussion questions and sample activities for your classroom. At the end of the study guide are additional resources you can find on the web to supplement and add to the information and activities we describe in the study guide.

### **Background Information: The Water Commons**

Water is essential for life on earth. Water is a commons, the trust of all humanity. Water is precious and sustains all life on earth. The right to water, like the air we breathe, is an inalienable, individual and collective right for all species. Each member of the human community has the right to water in quantity and quality sufficient to life and basic economic activities. Water belongs to the Earth and all species and, therefore, must not be treated as a private commodity to be bought, sold and traded for profit.

The intrinsic value of the Earth's water precedes its utility and commercial value and therefore must be respected and safeguarded by all political, commercial and social institutions. Creating the conditions necessary to ensure access to water for the vital needs of every person and every community is an obligation of society as a whole and the collective responsibility of citizens of the world.

The global water supply is a shared legacy, a public trust, a fundamental human right, and, consequently, a collective responsibility. Only by recognizing these principles at local, national and international levels can the commons be adequately protected.

## 1. Beneath the Surface

The title of this performance is *Beneath the Surface* because it provides a metaphor for the way water is always present, yet so often goes un-noticed in our lives. Water has such an every day presence in our lives that we tend to forget how essential it is to life. And, because water comes to our homes, schools and workplaces from under the ground and mysteriously and miraculously comes out of taps and fountains we often don't understand how this water gets to us and what happens to it when it leaves. Moreover, we also don't recognize current threats to the incredible public trust that provides us with clean water on a daily basis.

### Activities:

1. Have a discussion and make a list of all the ways you use water every day. Write a poem using these words.
2. What are all the different ways you see water every day?
3. Imagine you are a detective. Do you know where the water works are? Do you know when you are walking on water pipes in our city? How can you find the answers to these questions?
4. Fill a 2-liter bottle with water and add a few drops of blue food coloring to represent all the water on earth. Have students calculate 2.5% of 2 liters, placing the quantity (50 mL) in a clear container to represent the amount of fresh water on Earth.

Of this amount, remove 70% (have students calculate 35mL) to represent the amount of water trapped in glaciers and polar ice caps, or water that is too deep in the ground to be realistically recovered. The remainder – less than 1% of the Earth's total water supply is left to support human needs for agriculture, drinking and washing, as well as for lakes, rivers and freshwater ecosystems.

Have the class discuss the implications of this finite amount of fresh water available for all humans and species.

## 2. Drinking Fountains

According to architectural drawings and existing pipes, there was once a beautiful fountain at the center of the Avalon Theater (the original name of the Theatre now occupied by In the Heart of the Beast Puppet and Mask Theatre) yet the only trace remaining is a drinking fountain decorated with the sign “Out of Order”. Those who have come thirsty to the Avalon Theater in recent years have found their water for sale in plastic bottles.

This broken fountain is a sad shrine to the neglect of our public water “commons”. Throughout our country, as well, we have neglected to support public water and inadvertently supported a system of privatized water through the sale of plastic bottled water.

Drinking fountains are symbolic emblems of public water. They provide safe drinking water for the public to use, as needed. How can we celebrate such powerful support for the public good?

### Activities:

1. Have students draw a drinking fountain decorated in a way that expresses how much they value what it provides to the students of your school.
2. Decorate your school’s drinking fountain! Bring ribbons, crepe paper, and streamers from home. Have students make paper chains, signs, and banners to hang up around your drinking fountains showing your thanks for this wonderful public water source!
2. List the locations of the drinking fountains in your school. Do you drink from this fountain? Why or why not? When you are thirsty, what do you drink? Who built the fountains in your school? Who takes care of them? Why are the fountains in the locations they are in? Are they in convenient locations or are they in locations you never go? Have students draw maps of all the drinking fountains in your school. Post them near the entrances of your school so that visitors know where they can find water.
3. Figure out where the nearest drinking fountain(s) is/are outside of your school.
4. Have students design their own drinking fountain – have them design a drinking fountain that can allow 5 people to drink at the same time, or one designed for their school’s lobby, or one for their street corner! What other places need drinking fountains? Design drinking fountains for those places!
5. Check the conditions of your school drinking fountain. Is it working? Is it kept clean? Does *its* water taste good? If not, have students discuss this and plan to address these issues with school staff.
6. Do students and faculty use the drinking fountain? How many per hour? Post a drinking fountain monitor and have students record the number of users. Does your school “sell” water in plastic bottles? Find out how much is sold and where does the money go? What happens to the bottles? Are they recycled?

### 3. Circle of Water

The Earth's water is always in movement, and the water cycle (also known as the hydrologic cycle), describes the continuous movement of water on, above, and beneath the surface of the Earth. Since the water cycle is truly a "cycle," there is no beginning or end. Water can change states among liquid, vapor, and ice at various places in the water cycle, with these processes happening in the blink of an eye or over millions of years. Although the balance of water on Earth remains fairly constant over time, individual water molecules can come and go in a hurry.

Water is limited. The amount of water on Earth is all there has ever been and all there will ever be. Essentially, we drink the same water that ran through Roman sewers 2,000 years ago; we wash in the same water as *Tyrannosaurus rex*. Most of the earth's surface is water, but almost all of that is salt water or glaciers. Less than one percent is freshwater potentially available for human use and the environment. The United Nations says 2.7 billion people worldwide will face severe water shortages by 2025. Much of the world's water has been contaminated by industrial runoff, human sewage, and agricultural fertilizers and pesticides.<sup>1</sup>

#### Activities:

1. Beneath the Surface evokes this concept in a very visual way (i.e. puppets climbing up and down ladders in a beginning-less, endless cycle), much in the same way as the water cycle posters many of us have seen at some point in our lives. Have students make their own water cycle posters and include images they remember from the performance. A nice version of the water cycle is available (in various languages) from the U.S. Geological Survey at [www.ga.water.usgs.gov/edu/watercycle.html](http://www.ga.water.usgs.gov/edu/watercycle.html)
2. The water cycle contains its own interesting vocabulary (e.g. precipitation, evaporation, sublimation, infiltration, advection, run-off, condensation, evapotranspiration). The students could learn this vocabulary through spelling words for the week. Or, they could be included in their water cycle posters.
3. In a more hands-on activity, demonstrate how easily water changes form by having students collect snow from outside, bring it into the class room to melt into water and boil it. If Science facilities are available, they could boil it over a Bunsen burner, and then collect the water vapor in a glass receptacle hanging over the Bunsen burner. If not, boiling the water in a teapot and timing to see how long it takes for the water to evaporate could still be informative.
4. Remind students that the water they drink today was once used by the dinosaurs, in ancient Rome and throughout history, all because of the fundamentals of the water cycle. Pour a glass of water for each student and then make lists, individually or as a class of all the places that it may have traveled before it reached your cup!

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<sup>1</sup> <http://www.foodandwaterwatch.org/water/right>

#### **4. Minneapolis Water Works/Public Water Works**

Public drinking water in the Minneapolis region (including Columbia Heights, Crystal, eastern Edina, Golden Valley, Hilltop, New Hope, and partially for Bloomington) is supplied by the Minneapolis Water Works. They are responsible for water treatment, disinfection, and delivery to homes and businesses. One hundred percent of the public water provided by the Minneapolis Water Works comes from the Mississippi River. The City of Minneapolis recently made a huge investment in our public water system including the installation of a state of the art water filtration system. Minneapolis has an excellent public water system.<sup>2</sup>

However, in many other cities around the country, water pipes and treatment systems for both water and wastewater are aging and deteriorating amid more use from a growing population. This is causing environmental and health problems, including more and more sewage spills into our streams, rivers, lakes and oceans. For example, 2005 saw more than 20,000 beach closings and swim advisories, most of which were due to sewage overflows and malfunctioning sewage plants. The National Research Council recently warned that we should expect more water-borne disease outbreaks unless our leaders make “substantial investments” to improve America’s water pipes and systems.

Communities around the country are struggling to pay for the infrastructure improvements needed to solve these problems. However, because many city governments don’t have the money they need for making much needed improvements to their water infrastructures, some are considering contracting out the running of city water systems to private companies.

According to a recent Luntz poll, nine out of ten Americans believe that clean and safe water is a national priority that deserves federal investment. The federal government spends more than \$30 billion a year on a highway trust fund and more than \$8 billion on an air transport trust fund. Yet, we have no trust fund to safeguard our nation's water.<sup>3</sup>

Defined under the Clean Water Act and the Safe Drinking Water Act, the federal government has an obligation to help communities pay for public water. In spite of this, the government has cut the main source of funding for clean water year after year. Consequently, we are more than \$22 billion per year short of what is necessary to keep water safe for human and environmental health.

Publicly funded and managed water systems have delivered this essential resource to a majority of people in both the U.S. and the world. Americans strongly support federal funding for water. The development of our infrastructure has led to great gains for public health and has almost always been a basic service provided by governments. Water provision is good economic policy that offers a wide range of benefits to all people.

Water is intrinsically cheap but is invaluable. Over many decades, citizens have already paid for public water systems and their infrastructure. Because water has been seen as a public service rather than a commodity, rates have been kept low. Towns and cities usually have just one water company and one set of water pipes—whether public or private. Prices and water quality have been regulated by public agencies.

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<sup>2</sup> Facts About Metropolitan Council’s Operations and Programs; For Quick Reference, The Metropolitan Council. January 1998

<sup>3</sup> <http://www.foodandwaterwatch.org/water/trust-fund/trust-fund>

According to the United Nations Committee on Economic, Social, and Cultural Rights; “The human right to drinking water is fundamental to life and health. Sufficient and safe drinking water is a precondition for the realization of human rights.”

Armed with the belief that water is a common good and access to water is an inalienable human right we can protect the global commons of water. Water belongs to the Earth and all species and must not be treated as a private commodity to be bought, sold and traded for profit. Because the global water supply is a shared legacy, protecting it is a collective responsibility.

**Activities:**

Discussion questions:

1. What does the concept of collective responsibility, in regards to protecting the commons of water mean?
2. What do you know about the principles governing your city’s water?
3. Who makes decisions about the drinking water in your city? Write a letter to your mayor to find out.
4. Have students develop questions for your city’s waterworks. Do you want know how many miles of water pipes your city has? How many gallons of water does your city clean a day? How many gallons of water get used by the residents of your city every day? Write a letter from your class and see find out the answers. When you get the answers develop a quiz for the rest of the school and educate your entire school about your city’s waterworks.
5. Research the history of your municipal water system. In what ways has the ownership and/or management of the system changed?
6. Write or have a conversation with your mayor or councilmember and find out whether he or she has been approached by a water corporation. If so, find out what they promise to provide. Would the mayor or councilmember support having a public vote before any decision to privatize is taken?

## 5. Bottled Water

As recently as ten years ago, most people living in the United States and Canada took their drinking water directly from the tap or the water cooler in their workplace. Today, close to one-fifth of the population relies exclusively on bottled water for their daily drinking water. The withdrawal of larger quantities of water from springs and aquifers for bottling has led to depletion of vital water supplies. This deprives people of affordable public water and damages ecosystems.

Is Bottled water safer?

The bottled water industry has created an ad campaign in the United States that bottled water is cleaner, safer, and healthier than tap water. In fact, in the U.S. both regulation and enforcement of bottled water safety is weaker than of tap water safety. Federal, state, and local environmental agencies require rigorous testing of tap water safety. The Minneapolis Water works tests 300-400 times a day. The U.S. Food & Drug Administration regulates bottled water – but only if the water is sold over state lines – meaning up to 70 percent of all bottled water produced and sold within states is exempt from FDA regulation.<sup>4</sup>

What is the environmental impact of bottled water on the environment?

The manufacture of plastic bottles for bottled water has a great impact on the environment. It takes more than 47 million gallons of oil to produce plastic water bottles for Americans every year. The manufacturing process creates toxic and hazardous wastes. Millions of plastic bottles are not recycled. Only 23% of plastic bottled are recycled in the U.S., and we lead the world in plastic bottle recycling. Not very good for first place! Eliminating those bottles would be like taking 100,000 cars off the road and 1 billion pounds of carbon dioxide out of the atmosphere.

Is bottled water a waste of money?

Americans spent \$10 billion on bottled water in 2005 and paid up to 1,000 times the cost of production, a major windfall of profit for the companies. When purchased in small bottles, water can cost \$7.50 to \$11.00 per gallon in the supermarket but tap water costs most customers only one-tenth of one cent per gallon. What's more, nearly 40 percent of bottled water is tap water with added minerals or filtration. Where is the money we spend on bottled water going?<sup>5</sup>

### Activities

1. Do a blind taste test with tap water and bottled water, making sure that the temperature is controlled (one reason why people think they like bottled water more is because it is usually kept colder than the tap water we drink!). Chart the results.
2. Look at the labels on bottled water. Try to figure out where the water comes from. Is there enough information for you to figure anything out? Look at the pictures on the label – do the pictures have anything to do with where the water is from? What kinds of things do the pictures make you think about? Do the pictures match the reality of where the water in the bottles is from?

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<sup>4</sup> Much of the information in this section was taken from the following sites;  
<http://www.thirstthemovie.org/study.html>, <http://www.foodandwaterwatch.org/water/bottled> and  
[www.sierraclub.org/committees/cac/water/bottled\\_water/bottled\\_water.pdf](http://www.sierraclub.org/committees/cac/water/bottled_water/bottled_water.pdf)

<sup>5</sup> <http://www.foodandwaterwatch.org/water/bottled>

## 6. Waste?

“Something seems symbolic to me in that the minute a person sees and touches the water from their tap, it begins its journey back to the river. This point of unveiling of the water is a culmination of all the infrastructure and effort to make it pristine and it instantly becomes thought of as "waste". By an engineer who works for the Minneapolis Water Works.

Water comes to us in many conditions and from many sources; rain falls on our head, rivers run through our cities, snow collects on the bottoms of our cars, watermelons sit full of water, awaiting our purchase at the grocery store, pipes carry drinking water to our kitchens, to our sprinklers, and to our bathrooms. Although this water reaches us in a great number of ways, and although it undoubtedly leaves us in a different great number of ways, the water is never left unchanged by its contact with us and our world (and nor are we ever left unchanged by the water).

The ways in which we, as humans, change the water that will, in turn, inevitably change us and our world, are numerous, and *Beneath the Surface* is dedicated to exploring this idea.

The term “wastewater” is traditionally used to describe liquid discharges by domestic residences, commercial properties, industry, and agriculture. Although the Minneapolis Water Works is responsible for bringing the water into our homes and businesses, the Metropolitan Council Environmental Services is responsible for its reclamation and treatment. This means that the second the water leaves the tap and comes into contact with the air, it is no longer the responsibility of the Water Works, but rather the Metropolitan Council. At this point in time, the water is called “wastewater,” whether or not it was actually “wasted.” Some cities have opted for the term “water reclamation” instead, emphasizing the fact that, since it all returns eventually to river, no water is ever “waste,” though it can indeed be “wasted.”

Rain and melting snow act like a water hose, washing the landscape free of loose dirt and grime. While a good washing helps spruce up our communities after a long winter or summer dry spell, it does little for the health of our rivers, lakes and wetlands. That is because materials washed off the land eventually end up in the water, where they can become harmful pollutants.

Pollution caused by rain and snowmelt washing the landscape goes by several names. It can be called storm water pollution because it is caused by storms, runoff pollution because it is carried by rain and snowmelt runoff, and non-point-source water pollution, a technical name meaning it is different than point-source water pollution. Point source water pollution is the type of water pollution that comes from an industrial or wastewater discharge pipe — a definite point, or location, on the landscape.

Controlling storm water pollution is a challenge. The challenge comes from the fact that there are rarely only a few polluting sources. Rather, the combination of several sources, further complicated by several conditions such as the weather — something we definitely cannot control — are responsible for the resulting scope and intensity of the pollution. Controlling storm water pollution requires everyone’s action, from the homeowner to the business owner, from the road builder to the street sweeper.

We all have the opportunity to keep the landscape cleaner so rain and snowmelt have fewer pollutants to wash away into our water. <sup>6</sup>

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<sup>6</sup> <http://www.cleanwatermn.org/learn/stormwaterplltnts.asp>

### Activities:

1. Read the quote at the beginning of this section to your students and then ask students to consider the word wastewater. Discuss how words affect our care and respect for the water. What might be other names we could give to our wastewater plant? Have a contest in your school for a new name for your city's wastewater plant.
2. To get reports on water quality from your local water utility, local environmental groups, and/or State Health Department or . Source Water Assessments for your town are available at: <http://www.health.state.mn.us/divs/eh/water/swp/swa/>  
Information from the Minnesota Pollution Control Agency can be found at: <http://www.pca.state.mn.us/water/index.html>
3. (For students in 7<sup>th</sup> grade or higher) The Metropolitan Council offers tours of its wastewater treatment sites. They provide a thorough, step-by-step explanation of wastewater treatment. Tours are approximately two hours in length and are available at regular times and dates. There are no fees for the tour, but reservations must be made two weeks in advance. For scheduling information contact Linda Henning, Special Projects Manager, at 651-602-1279 or [linda.henning@metc.state.mn.us](mailto:linda.henning@metc.state.mn.us).
4. Ask the school building engineer(s) to show your students the school's water system. Your school probably has a blue print of the school containing the location of the building's water pipes; see if your students can locate them in a sort of treasure hunt. This free, simple "field trip" can be engaging, offering the kids an opportunity to see first-hand how water and sewage systems are designed as well as a chance to interact with the engineers that maintain them. Chances are that your students have wondered at least once what lies behind some of those locked doors!
5. Research the history of lawns to find out how much water is being used for them. How about golf courses?
6. Could you harvest rainwater from your school building for a school or community garden? Investigate ways to harvest rainwater from your school's roof for use in the school's garden, a community garden or a neighbor's garden. This web-site has information about rain gardens: <http://ricecreek.org/bmp/rg>

Other best management practices that schools could implement would be:

- ♣ Install rain barrels at the school building's downspouts or even reroute downspouts so that they drain to pervious areas.
- ♣ Install rain gardens to capture runoff from paved areas of the school grounds.
- ♣ Repave impervious areas such as walkways, parking lots and patios with pervious pavers to allow runoff to infiltrate (this could be costly but less so when those areas are being repaved anyway).
- ♣ Because turf areas that get a lot of traffic can become compacted and functionally impervious, consider removing some areas of turf lawn and installing butterfly gardens, prairies, vegetable or flower gardens which do a much better job of infiltrating runoff.

## 7. The Watershed

A watershed (also, drainage basin) is an extent of land where water from rain or snow melt drains downhill into a body of water, such as a river, lake, dam, estuary, wetland, sea or ocean. The drainage basin includes both the streams and rivers that convey the water as well as the land surfaces from which water drains into those channels. The drainage basin acts like a funnel - collecting all the water within the area covered by the basin and channeling it into a waterway. Each drainage basin is separated topographically from adjacent basins by a ridge, hill or mountain, which is known as a water divide. The Mississippi River drains the largest area of any U.S. river and is ranked the third largest watershed in the world, covering over 1,245,000 square miles and all or part of 31 U.S. states, and two Canadian provinces (EPA).

Everyone living and working with a watershed needs to cooperate to ensure healthy conditions because water moves downstream in a watershed. Any activity that negatively affects water quality at one point along the drainage basin will negatively affect every single point that follows. The result of repeated mistreatment is magnified, not diluted, during the progression of the water through a watershed.

Simple choices in daily activities that can negatively affect watershed health include: dumping used motor oil down a sewer; over-fertilizing lawns and gardens; raking leaves into the street; washing your car in the driveway or street; applying sand and chemicals to driveways and sidewalks; removing vegetation such as plants, trees, and grasses along a riverbank; leaving pet waste on the ground; and poorly maintaining home septic systems. Communities as a whole can also affect the water quality of a watershed through land use decisions such as where to locate housing, shops, factories, parks, and farms. By analyzing a watershed's physical characteristics and land use patterns, students will understand how their watershed is changing and what they can do to protect it.<sup>7</sup>

Other things cities can do to reduce polluted runoff and improve watershed health include:

- ♣ Implementing infiltration best management practices (BMPs) such as infiltration trenches and rain gardens whenever streets are reconstructed. Most cities replace and reconstruct their streets, curb and gutter on a 30-40 year cycle. Since streets essentially convey all stormwater to the storm sewers and then on to local lakes and rivers, if we eventually retrofitted all of our streets with infiltration BMPs our cities would no longer contribute polluted stormwater to our waters.
- ♣ Changing development rules that require large amounts of parking, essentially mandating impervious surface.
- ♣ Changing city codes that require wide street widths
- ♣ Implementing strong construction site erosion control ordinances and enforcement mechanisms (construction site erosion (According to the US Environmental Protection Agency, construction sites erode at a rate of 75 tons per acre per year compared with 7.5 tons per acre per year for row crops and 0.4 tons per acre per year for urban lawns.)

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<sup>7</sup> [http://earthday.net/educators\\_guide\\_to\\_water\\_quality](http://earthday.net/educators_guide_to_water_quality)

**Activities:**

1. What does it mean to be the headwaters? What does it mean metaphorically? Always receiving water and always letting water go from us. Because we, as Minnesotans, are the headwaters, we are always at a beginning and can always do more, as leaders, to protect our water.
2. Get reports on water quality (available at <http://www.ci.minneapolis.mn.us/water/index.asp>), from your local water utility, local environmental groups, and/or State Environmental Protection Department.

Compile all the results as a class and brainstorm about what the results mean. Translate into real world language. Compare with existing reports on water quality from local expert resources.

3. Have the class determine and diagram (chalk or draw map) the source of their community's fresh water. Predict events or circumstances that could negatively affect the availability and health of the community's drinking water. What would the impact be if the community water source ran dry? Brainstorm ways in which the community could reduce its freshwater consumption.
4. Have students consider implications on the limited fresh water supplies by writing a law for Congress to consider that would penalize companies that introduce toxic waste into any ground or surface water.

Have a debate over the proposed law.

5. What is your watershed address? To locate your watershed go to: [www.epa.gov/surf](http://www.epa.gov/surf)
6. How does one area of the watershed impact another area? Consider an industrial accident on one part of a river. How many other areas along the river are impacted?

## 8. The Pollution of Our Water and the Dead Zone

Pollutants on the ground anywhere in a watershed can wash into lakes and stream with the next rain. In cities and towns, storm sewer pipes carry untreated, polluted water directly to the nearest lake or river. Today, the greatest threats to water quality are pollutants from lawns, farms, hazardous waste, animals, driveways and parking lots, as well as trash.<sup>8</sup>

Pollution that comes from a single, identifiable source, such as a factory or discharge from a sewage treatment plant is called point source (PS) pollution. Once the source is identified, it becomes easier to improve water quality. Non-point source (NPS) pollution is attributable to diverse sources. The EPA reports that NPS pollution is a leading cause of water quality problems. NPS is primarily caused by rainfall or snowmelt moving over and through the ground causing runoff to pick up and carry away natural and human-made pollutants. This runoff finally deposits the pollutants into lakes, rivers, wetlands, coastal waters and even our underground sources of drinking water.<sup>9</sup>

Agriculture's chemical fertilizers, pesticides, and livestock wastes degrade water quality, as well. Agricultural pollutants are rich in nutrients that encourage the growth of oxygen-depleting algae. Native fish and shellfish that lack sufficient oxygen either die or are displaced. In some rivers and lakes, oxygen levels are so low that there is virtually no aquatic life. Agricultural runoff is still the largest source of polluted runoff in the US. Nutrients, pesticides, bacteria and sediment are the pollutants of concern.

Heavy industrial processes are responsible for a wide range of water pollutants, including solvents, oils and toxic chemical byproducts. Coal-fired power plants are the largest emitter of highly-toxic mercury pollution. Health agencies in 40 states have issued advisories against consuming fish from mercury-contaminated waters.

Households use and accumulate a wide variety of chemicals, including paints and paint thinners, stains, glues, oils, pesticides and fertilizers. In most areas, facilities exist for proper disposal of toxic household waste. Yet people often throw away hazardous wastes or pour them down the drain, contaminating the water supply. In addition, in urban areas, large areas of land are covered with homes, pavement, roads and lawns. This limits the ability of water to soak into the ground, which acts as a natural filter and prevents groundwater recharge. Instead, the water flows over pavement and chemically treated lawns, taking toxins with it.<sup>10</sup>

Agricultural runoff and other water pollution that flow down the Mississippi River eventually flows into the Gulf of Mexico. Since at least the mid-1980's it has been apparent that nitrogen carried into rivers of the Mississippi River Basin is fueling tremendous algal growth in the Gulf in the spring and summer months. Decomposition of this algal biomass consumes dissolved oxygen in the water column, leading to a condition called "hypoxia". In these conditions, very few marine organisms can survive; hence the area affected by hypoxic conditions is referred to as the "**Dead Zone**."<sup>11</sup> When oxygen levels become depleted to the point that the area cannot support marine life, sea creatures must swim to other waters or die. Besides being inhospitable to most sea life,

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<sup>8</sup> [http://cgee.hamline.edu/watershed/action/projects/ppp\\_guide.htm](http://cgee.hamline.edu/watershed/action/projects/ppp_guide.htm)

<sup>9</sup> [www.earthday.net/educators\\_water\\_guide](http://www.earthday.net/educators_water_guide)

<sup>10</sup> <http://www.earthday.net>

<sup>11</sup> <http://www.ewg.org/node/21041>

algal blooms also cause dead zone waters to turn brown.<sup>12</sup>

Reducing and preventing non-point source pollution requires action on federal, state and local levels. Federal responsibilities include ensuring that federal lands are properly managed to reduce soil erosion. State responsibilities include developing legislation to govern mining and logging to protect groundwater. As citizens we play an important role by practicing conservation and by making it our personal business to properly dispose of home hazardous waste water, using non-polluting lawn supplies, recycling plastics and other detrimental debris. Finally, instilling an awareness that will engender careful and conscious practices in our daily activities will ultimately protect our water commons.<sup>13</sup>

**Activities:**

1. In the spring months, take your students to a nearby stream, lake, river, or pond to test water quality (a few instruments will be necessary, such as test strips). Alternatively, you can have them collect water samples on their own from different sources and compare results from your community's different bodies of water. Things to test for include fertilizers (especially nitrates and phosphates), acidity, and pesticides. Have students make a note of the visible condition of the body of water, including water color, the size of the lake/stream/river it came from, the amount of larger debris such as litter and leaves, the amount of wild life (plant and animal) that live around it, etc. Why might some water ways be more polluted than others?
2. Create a stencil with the slogan "Protect our Water Commons – Only Rain Down the Drain" and paint it next to all the storm drains near your school. Or, have a contest for the best slogan and design and paint that next to all the storm drains near your school! [Students will need permission from the city (public works) to do storm drain stenciling. Usually stenciling also includes dropping doorhangers at homes that explains the issue.]

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<sup>12</sup> <http://science.howstuffworks.com/dead-zone.htm>

<sup>13</sup> [http://www.earthday.net/educators\\_water\\_guide](http://www.earthday.net/educators_water_guide)

## 9. What is the Commons?

The commons is a generic term. It can mean many things to many people, and the definition is evolving. In a dictionary you might find “commons” defined as a dining hall at a college or University, or historically as is a piece of land on which neighbors have a right to graze their animals.

Wikipedia says “The word ‘Commons’ has now come to be used in the sense of any sets of resources that a community recognizes as being accessible to any member of that community. The nature of commons is different in different communities, but they often include cultural resources and natural resources.”

### **Activities:**

Give a brief definition of the commons.

A working definition that we often use at Tomales Bay Institute is “the vast wealth of nature and humanity that we inherit together and must pass on, undiminished, to future generations.” We think any definition must indicate that the commons has value, that it includes both natural and socially-created things, that it is an inheritance—it was given to us, and we have an obligation to protect it.

Repeat this definition and write it on the board: “The commons is the vast wealth of nature and humanity that we inherit together and must pass on, undiminished, to future generations.”

To better understand what the commons is lets look at what it does:

The commons provides basic sustenance: for most of human existence, the commons supplied everyone’s food, water, fuel and medicines.

The commons is the ultimate source of all natural resources and nature’s many replenishing services.

The commons is the ultimate waste sink: it recycles water, oxygen, carbon and everything else we excrete, exhale and throw away.

The commons is our knowledge bank and seedbed: it holds humanity’s vast store of science, art, customs and laws, and is the seedbed of all human creativity.

The commons is communication: humans communicate through shared languages that are living products of many generations.

The commons is community: the village tree, the public square, Main Street, the neighborhood and the Internet. Outside of families, it’s the glue that holds us together.

### **Naming the Natural Commons:**

Tell participants they are going to write an instant poem about the natural commons. Ask them to use descriptive language. It is OK to use fragments of sentences and thoughts. Encourage them to keep writing, let their thoughts flow and not go back to edit.

They should use the following to start each section of the poem--in this order.

Above me I see  
Below me I see  
Inside me I see  
All around me I see

Give participants 5 minutes to write. Share and discuss the poems.

So as to avoid repetitious responses (e.g. “a desk, the teacher, the roof,” etc.) this might be a good one to do outside or on the student’s own time.

### **Naming the Social Commons:**

Explain the social commons—assets created by people over time. Give a few examples: museums, hiking trails, languages, recipes. Ask participants to each create a list of 3-5 items.

Draw 2 columns on the board labeled “Me” and “We.” As participants take turns calling out items from their list, lead discussion and write the items in the column that the group thinks they should be in. To whom do they belong? And who created them—individuals or humanity? Some items could be in both. Some may not fit at all.

## 10. Homage to Water

What do you do if you are overwhelmed with all this information? Write a poem to thank water for what it gives you. Make a picture of an animal enjoying water. Imagine that you are an old person with children and grandchildren. How would you like the water to be for them? Write a poem thanking the water for years of nourishment.

## 11. What If? What you can do!

What if we all agreed to do our part to protect the water commons? What would we do? What would we do differently? What information would we need to be more informed and make better choices to help protect our water?

### Activities:

Trace the toxins in your home.

How would you clean without chemicals?

How would you take care of your lawn and garden without toxins?

What do you flush down the toilet what do you throw in the street?

Have students make a list of things they can do – in school, at home and when they are out and about!

Have students write a persuasive letter to the Editor of the local newspaper about why it is important to protect our water, our responsibility to future generations and the need to support public water.

Take a look at the resources and web-links at the end of this study guide. Do research on different kind of actions that can be taken and evaluate how effective they are.

Want to help protect the commons of water? Here are ten simple things you can do:

1. Become an advocate for water – make t-shirts, make signs and let people know!
2. Honor and protect waters as a commons, a vital resource we all share and own together
3. Learn as much as you can about all aspects of threats to water, especially privatization schemes in the U.S. and around the world
4. Don't buy bottled water -- *drink tap water!* In Minnesota its healthier for you.
5. Carry your own water bottle that you fill with tap water
6. Conserve water – be conscientious about how much water you use and how much you *NEED*.
7. Remember that everything that goes down the sink, on your lawn, in your garbage and into your storm drain eventually finds its way into our water. Be thoughtful and vigilant.

8. Learn about your sources of water – ask questions to learn about where your water comes from? What challenges and problems do your water sources face?
9. Celebrate the fact that our taxes fund public water works, which provide us with clean safe drinking water 24 hours a day, 365 days a year.
10. Join efforts to preserve democracy in water systems. Your voice needs to be heard. Use it on issues related to promoting water as part of the public commons – in your city, your state, your country and the world.