2011 Edition

Stream of Consciousness

a publication of the Alliance for Aquatic Resource Monitoring

Alliance for Aquatic Resource Monitoring • est. 1986 •

Educate. Engage. Empower.

The Silver Anniversary is Here!

By: Virginia Farley

"Educate. Engage. Empower." The strength (and catchy alliteration) of this ALLARM slogan (developed in 2004) is repeatedly spotted on ALLARM paraphernalia. However, this slogan is not just for our logos and staff t-shirts. It is a message that ALLARM hopes to spread as far as its umbrella will reach and can be rooted back to the Alliance for Aquatic Resource Monitoring's initial foundation. Organizations, no matter their realm, are most commonly started with a problem to solve and a goal in mind. The Alliance for Aquatic Resource Monitoring (ALLARM) began with the issue of acid rain and with the goal of protecting Pennsylvania's streams. Starting specific and spreading its grassroots out, ALLARM is an entity we hope is living up to our catchy slogan. The year 2011 marks ALLARM's 25th anniversary. 1986 brought the creation of ALLARM and 25 years later, we have a lot to celebrate.

A lot more than just our name has changed in the past quarter century, but nevertheless the organization's original acronym rang to the tune of the "Alliance for Acid Rain Monitoring." Founded by Dr. Candie Wilderman, a Dickinson College professor, ALLARM's ambitious goals were targeted at the volunteer monitoring community and its efforts to document the effects of acid precipitation on Pennsylvania's streams. The motto, "public education through participation" was often thrown around as ALLARM's tagline and is still relevant to today's organization. By offering scientific training to over 700 volunteers representing every Pennsylvania county, the end result concludes in the most comprehensive database of pH and alkalinity of Pennsylvania streams.

As the ALLARM family grew so did its projects and accomplishments. Expanding from the realm of acid rain ALLARM incorporated additional programs into its itinerary. 1993 marked the beginning of Students Monitoring Acid Rain Together (SMART) and focused on educating students (K-12) about

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acid rain and the environment. Through this program ALLARM hoped to cultivate children's interest in both science and the environment as well as show children that their participation is important in solving environmental issues. Although no longer entitled the "SMART" program, ALLARM still continues its K-12 outreach in South Central Pennsylvania through its Environmental Education program. In 2000, ALLARM commenced its first project addressing stormwater pollution in Carlisle as a result of receiving grant money to implement restoration projects along the Mully Grub – a tributary to the LeTort Spring Run that carries 20% of Carlisle's stormwater to the LeTort. Starting in 2007, ALLARM's stormwater work grew with the new LeTort Stormwater Education Campaign, a partnership with the Borough of Carlisle, Cumberland Valley Trout Unlimited, and LeTort Regional Authority.

The biggest organizational shift came in 1996 when ALLARM experienced major growth. ALLARM hired its first full-time director, Lauren Imgrund, amdchanged its name to Alliance for Aquatic Resource Monitoring; and tailored its mission to respond to requests from communities to monitor their watersheds. In 1996, we expanded our focus to work with watershed associations on multiple issues to assess, protect and restore Pennsylvania's streams. Since that time we have trained more than 3,000 individuals who have implemented over 11,000 square miles of watershed assessments, addressing a range of issues and resulting in stream upgrades, conservation plans, public education and informed debate, participation in permit hearings, and local zoning improvements.

Twenty-five years later, we have provided 41 watershed organizations with technical assistance to implement volunteer monitoring studies. For 25 years, ALLARM has successfully trained and engaged volunteer monitors to investigate and answer questions about the myriad of issues facing our state's water quality. ALLARM's philosophy is centered around bottom-up engagement, capacity building by involving Pennsylvania communities in every step of the scientific process, including: defining the research agenda, designing the study, collecting and analyzing data, managing and interpreting the data, and bringing the data to the public for action. When faced with the severity of natural gas drilling in the Marcellus Shale, ALLARM developed a Marcellus Shale volunteer monitoring protocol to ensure that Pennsylvania streams are aptly monitored and protected. With 25 years of history, we at ALLARM are looking to celebrate! Next fall we will be commemorating ALLARM's history, by presenting our current project with Marcellus Shale and reflecting on all works past and present, we hope to offer more insight into what ALLARM is while celebrating our 25-year journey. Plans of a multimedia presentation of our history, timelines, and many visuals are in the works to articulate the vast history of our organization. The truncated version of ALLARM's history presented in this article will be greatly expanded and we at ALLARM are ecstatic to share this with all interested.

In 25 years ALLARM has changed its name, relocated its offices, cycled through five professional staff and approximately 140 student employees, worn three logos, and incorporated new projects while putting to rest others. Even in the adaptive entity that ALLARM has become, our primary goal of monitoring and protecting Pennsylvania's waterways has remained consistent. Empowering communities with scientific tools to understand stream health is the impression ALLARM hopes it has left since 1986. We could not be happier with the road ALLARM has traveled over the past 25 years and we are excietd to see where the path will lead us. Thank you to our extensive ALLARM family and volunteers for 25 years of support and dedication and we can only hope for an additional successful 25 years!

First ALLARM Logo

ALLARM logo 1996-2010

New ALLARM logo 25th Anniversary

Monitoring in the Marcellus Play

By: Giovania Tiarachristie

Staff member Christie Anderson '13 listening to volunteer questions at a Marcellus Shale workshop.

At the front lines of national energy development, especially in the Marcellus Shale region, there have been few more crucial times than now for the role of volunteer monitors. In 2010 alone, there were 3,314 new drilling permits issued in the state of Pennsylvania (DEP 2011). The question brought forth by concerned residents is: Will the environmental and health costs from potential air, water, and soil contamination be compromised for the economic benefits of extensive gas drilling?

Residents are most concerned about water quality impacts of the process of horizontal drilling and "hydrofracking", which forces sand, a chemical mixture, and more than a million gallons of water pumped from Pennsylvania streams into the formation to capture the natural gas. Some of that water remains in the formation, but the "flowback" waste water that comes back to the surface from fracking is ten times saltier than ocean water (Stoltz 2011) and is full of hundreds of chemicals and dissolved solids, which wastewater treatment plants do not have the technology to purify (Sapien 2009). These chemicals include barium, strontium, iron, and arsenic; toxic organics such as benzene and toluene; recently revealed diesel fuel; and also naturally occurring radioactive materials such as uranium (Stoltz 2011; Dally, 2011). This contaminated, indispensible water poses potential irreversible threats to PA's streams, groundwater, and drinking water. There have been dozens of contamination and violation cases, among many, an 8,000 gallon chemical spill into groundwater in Dimock, PA (Lustgarten 2009), a 30 mile fish kill in Dunkard Creek (Scherer 2010), an open valve spill in Lycoming County (Levy 2010), and a 28 cattle quarantine due to a wastewater leak in north-central PA (Kusnetz 2010). The role of volunteer monitors has thus become crucial, because the Department of Environmental Protection (DEP) does not have the capacity to monitor subtle changes in small streams where most of the drilling activity occurs. With budget shortages in the DEP and the escalating urgency of more contamination, statewide partners and agencies have called upon ALLARM for assistance to take leadership in what it does best: training volunteer water monitors.

What began in 1986 to monitor acid rain has diversified its issues and expanded since 1996, focusing to work with watershed associations. With the Marcellus Shale issue at hand, ALLARM continues to keep up with the current issues of its time to strive to fulfill its mission: protect and restore Pennsylvania's precious waterways.

For seven months, with the

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"Monitoring Marcellus" continued from page 3

help of ALLARM science director Candie Wilderman while on her sabbatical, Assistant Director Jinnie Woodward, and a team of students developed a Marcellus Shale Volunteer Monitoring Protocol that aimed to be practical for volunteers, yet vigorous enough to detect contamination through flow monitoring, chemical testing, and visual assessment.

"The model we're promoting is identifying contamination by comparing test results to baseline data," says Wilderman. "Volunteers conduct weekly baseline monitoring for as long as possible, followed by 'watchdog' monitoring after the drilling activity begins" (Simmons 2010).

At the end of June 2010, ALLARM launched its first pilot training workshop (with the help of GIS post-doc Simona Perry) in Bradford County. Since then, ALLARM has conducted twenty-three trainings as of July (ten in collaboration with Trout Unlimited), and continues to improve the learning experience and quality of the protocol through volunteer feedback. The workshops train volunteers to use a 5-step action plan:

1.Determine where drilling permits are approved.
2.Determine available resources (how many sites and monitors)
3.Monitor streams before, during, and after drilling activity
4. Interpret and manage data.
5. Report pollution event to agencies

The workshops involve communities in every step of the scientific process in grass-roots capacity-building training. "The training in the proper procedure to take samples, the training on the equipment, answering our questions, and the subsequent follow up by ALLARM group has been phenomenal… Our community is going through unbelievable changes… ALLARM has helped us understand and to deal with those changes," comments John C. George, Chairman of the Wysox Creek Watershed Organization (WCWA) who participated in a training.

"My wife and I monitor six sites weekly. It takes a little time and effort but we firmly believe that if the water in our town becomes unsafe, we will know it before anyone is harmed," shares Joe Clutter, the mayor of Rome, a small town in Bradford County.

Delaware Riverkeeper Network, Trout Unlimited, Mountain Watershed Association, and a handful of other service providers have adopted the ALLARM manual to train communities to monitor small streams and their watersheds for early detection of the impacts of Marcellus Shale gas extraction in PA. ALLARM has also received positive agency feedback on our manual from the PA Department of Environmental Protection, the Environmental Protection Agency, and the Susquehanna River Basin Commission.

ALLARM was receiving daily phone calls inquiring about its protocol, and meeting the increasing demand for training and resources, given limited funds at the time, became challenging. Fortunately, in November 2010, the Colcom Foundation approached ALLARM with interest in its monitoring manual and role in the Marcellus Shale issue, and awarded ALLARM with $185,000 to continue and expand its program. With this funding, ALLARM plans to:

1. Strengthen the protocol with quality control testing
2. Disseminate technical assistance and trainings in 22 Western Pennsylvania counties
3. Provide free monitoring equipment to volunteer monitors through a lending program
4. Develop online training resources, including refresher training videos and voice over PowerPoints on the various steps in the protocol.

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Virginia Farley '13 helps with the hands-on activity at a Marcellus Shale workshop

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A Missing Piece in PA Natural Gas Drilling

By: Taylor Wilmot

http://itd.idaho.gov/Projects/images/nepa.gif

http://americandigest.org/rer_65_1.jpg

The purpose of Environmental Impact Statements is to create a plan early in the process of land-use projects, in order to evaluate potential impacts & protect the environment from detrimental effects (Askin, 2007). Environmental Impact Statements, or EIS, were first introduced to the United States in 1970 (Barrett, 1979). Since then they have been a prominent part of environmental policy, and other countries have also adopted this practice.

Under the National Environmental Protection Agency, NEPA, all federal agencies are required to submit an EIS for any proposed actions that will have a significant effect on the environment. As part of the EIS process, there is a set time period to review the statement, after which edits will be made to address concerns voiced during public hearings (Spross, 1984). When a final Environmental Impact Statement is submitted, a panel will meet, review the document again, receive public comments, and hold a hearing; after which, a final recommendation will be submitted by the panel. This requirement of creating EIS provides an opportunity for the community to have a voice in the regulatory process.

Each state has its own processes for regulating actions that may affect the environment, which are not federal projects, and therefore do not fall under NEPA. In New York state regulation for natural gas drilling is the responsibility of the Department of Conservation and the permitting process is conducted by the Mineral Resources staff (NYDEC, 2009). The New York Department of Environmental Conservation has created a draft Supplemental Generic Environmental Impact Statement on oil and gas development in the state (NYDEC, 2009). The responsibility for regulating natural gas drilling in Pennsylvania falls under The Bureau of Oil and Gas Management, specifically the Oil and Gas Act (DEP, 1984). According to this act, there is no Environmental Impact Statement requirement. However, there is a list of permits that must be approved by various agencies including Pennsylvania Department of Environmental Protection and River Basin Commissions. There is also an opportunity for public input during the permitting process and development could, theoretically, be revoked or delayed due to this input.

One benefit of the Environmental Impact Statements is that it slows down the process and provides time for reflection, review, public comment, and for raising awareness. When comparing natural gas drilling in the Marcellus Shale region in New York and Pennsylvania, EIS's play a major role in how fast drilling can begin. In Pennsylvania, Marcellus Shale natural gas drilling began in 2005, but in New York hydraulic fracturing has yet to begin.

By contributing to the delay of drilling the EIS has benefited environmental organizations, community groups, and concerned citizens. More preventative strategies can be put into action to protect their watershed. One

"EIS" continued on page 6

"EIS" continued from page 5

example of this is collecting baseline data, which is vital in issues of water contamination due to the drilling process. The longer baseline data is collected, the stronger the case will be in a contamination incident. In many parts of Pennsylvania, little or no baseline data have been acquired before drilling began.

Pennsylvania's natural resources have been harvested since its establishment from timber, to coal, and now natural gas. To date over $13 billion has been put into addressing acid mine drainage in the coal regions – demonstrating the need for Environmental Impact Statements. An Environmental Impact Statement requirement is a key tool for non-federal agencies who want to propose land-use projects in the commonwealth of Pennsylvania. An Environmental Impact Statement would greatly benefit Pennsylvania with natural resource extraction, specifically with the Marcellus Shale natural gas play. If the Department of Environmental Protection was required to develop a Generic Environmental Impact Statement, before natural gas drilling in the Marcellus Shale could begin, specific effects of the drilling process could have been taken into account.

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"Monitoring Marcellus" continued from page 4

Meanwhile, ALLARM will also continue to build rapport with key Western Pennsylvania organizations and to advertize resources.

Although ALLARM provides services and support, the key players in the preservation of our waterways are the volunteer monitors who collect baseline data. Volunteers have an advantage because they have local knowledge and can gain access to private property to sample frequently.

DEP is also calling on citizens to monitor. "We do not have the resources to conduct baseline testing prior to the start of drilling activities...We strongly encourage citizens who want to be involved in protecting their water resources to participate in volunteer monitoring programs." (Nels Taber, Regional Director of DEP, October 2010). The presence of well-trained volunteer monitors around and near well sites will also be an incentive for companies to adopt stronger better management practices during their extraction activities. The time to monitor is now.

Clutter continues, "So many things in life are beyond our control. Because of this program...I can sleep nights feeling that I have at least some control over the safety of our community.

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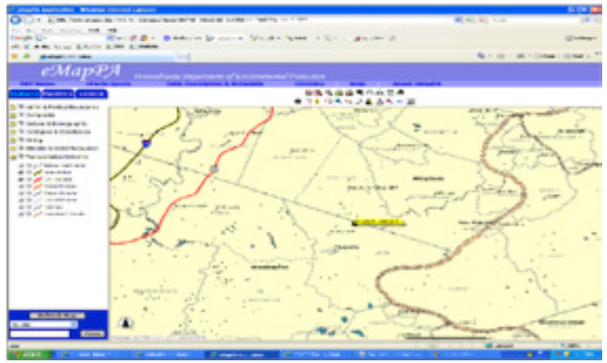
EmapPA and eNotice Protocol Development

By: Katie Tomsho



Permit location found by using eNotice in conjunction with eMaps

Marcellus Shale natural gas extraction has quickly become one of Pennsylvania's most pressing environmental issues. The extraction process as well as the associated industrial development has created concern over the impacts on the surrounding area. Numerous individuals and water monitoring teams interested in learning about how they can supervise and protect their valuable aquatic resources from gas extraction impacts have contacted ALLARM.

ALLARM recognized the necessity of developing a volunteer monitoring protocol specifically related to Marcellus Shale, and initiated research and development in the fall of 2010. Candie Wilderman, Professor of Environmental Studies at Dickinson College and founder of ALLARM, dedicated her sabbatical that semester to Marcellus Shale research in conjunction with the development of the ALLARM monitoring protocol. As the interest in the protocol increased, the urgency for its development rose, and the first Marcellus Shale volunteer monitoring workshops were arranged for the summer months of 2010.

In developing the protocol, ALLARM Director Julie Vastine, Assistant Director Jinnie Woodward, and Candie Wilderman held multiple meetings with other involved organizations, such as Trout Unlimited, as well as with concerned citizens. The aim was to understand the interests and needs of the individual monitors,and to develop a protocol that could effectively and economically allow them to supervise and protect their waterways from potential Marcellus Shale drilling impacts. Baseline data, collected before drilling, are necessary to demonstrate that there has been a change in the conditions of the waterway. The ALLARM protocol states that at least a year of baseline data is desired in order to identify natural fluctuations in the waterway throughout the seasons. However, it is not always possible to collect this amount of baseline data before the drilling occurs. Thus, it was necessary to determine a way to locate future drilling sites at the earliest possible occasion. ALLARM recognized that there was the potential to utilize the Pennsylvania Department of Environmental Protection's (DEP) permitting process via their eMapPA and eNotice services to keep track of potential future drill pad sites. It would be necessary, though, to teach the volunteer monitors how to use these tools. As one of three students working at ALLARM's 2010 summer program, I was given the opportunity to contribute to the development of this vital protocol. My specific task was to determine if there was a way of using eNotice and eMaps to stay up to date with the DEP's approval of drilling pad permits and if there was a way to map their planned locations.

Initially, I set out to familiarize myself with the eMapPA program provided by PaDEP. This included understanding tools, symbols, and terminology, as well as the legislation behind the individual permits necessary for developing drilling pads. I registered with eNotice, a service connected with eMapPA, which allows individuals to receive email updates on the status of specific permits within locations of their choosing. I used the emails that I received to learn how to access information, and to use the changing permit information to determine how to map the eventual drilling

"Emap and eNotice" continued on page 25

The Land-Water Living Classroom

By: Christie Anderson

A small site along the Yellow Breeches Creek has become Dickinson College's Land-Water Living Classroom and the subject of one of ALLARM's projects this year. Though this land belongs to the College, it is leased to a family, who currently uses it as a grazing area for their dairy cows. There is a thin riparian buffer, which is the natural vegetated area beside a stream, between the grazing pasture and the creek. However the cattle do have a small, fenced-in access area where they can directly enter the water.

This location is of importance to ALLARM because of the livestock's potential impacts on the Yellow Breeches. Stream bank stability may be reduced as the removal of vegetation and trampling along the stream bank can cause soil erosion. Walking in the stream stirs up sediments and increases total suspended solids in the water. The width of the riparian zone may be reduced in order to expand the amount of land for cattle grazing. These vegetated streamside areas are crucial for infiltration of water and filtration of pollutants present in runoff (Hoorman & McCutcheon, 2005b). ALLARM is also concerned with the impact that manure pollution may have on the waterway in the form of nutrients, such as nitrogen, and bacteria, which could indicate the presence of pathogenic organisms (Hoorman & McCutcheon, 2005b) (Meays, 2004). Bacterial Source Tracking (BST) will be used for this study if it is feasible. This process genetically identifies which animals (humans, wildlife, or livestock) contributed to the fecal pollution, which allows for greater certainty that manure impacts are attributed to the cattle (Meays, 2004).

The main goal is to remediate the Land-Water Living Classroom while using the site to conduct a study on how runoff, which carries pollutants, and direct livestock access to the stream degrade stream quality. It is important to compare upstream water quality to downstream water quality, so monitoring will take place at three sites: downstream from the cattle access area, just after the cattle access area in the mixing zone of any pollutants, and upstream from the access area and field. The parameters that will be monitored are daily weather, flow, temperature, dissolved oxygen, total suspended solids, nitrates, orthophosphates, trace metals, macroinvertebrates, fecal coliform bacteria, and e-coli bacteria. These parameters will be measured over multiple seasons for at least two years in order to gather concrete data. Weather is important to monitor since rain events could influence the results gathered during monitoring. Collecting data during multiple seasons is also important in order to identify the stream's natural variation. Additionally, the seasons may determine the location of the Hoover's dairy cows. Parameters will continually be monitored during and after the remediation of the site in order to assess the remediation efforts.

The Landwater Living Classroom site at the College Farm.

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Remediation of the site may include best management practices or practices to control the effects of livestock grazing, such as adding plants to widen the riparian buffer zone, giving the cattle an alternative water source if they do not have one, or further restricting their access to the creek (Hoorman & McCutcheon, 2005a). A study featured in *Environmental Management* found that a vegetative buffer of at least one meter can reduce fecal coliform bacteria levels that reach water by 99 percent (Sullivan, 2007).

The Land Water Living Classroom will not only serve as a research site for ALLARM but will also incorporate other Dickinson College departments as well as the College Farm. The site has already been used as an educational tool for a first year seminar class at Dickinson that learned to conduct a visual assessment of the stream, and an environmental health class that collected water samples for fecal coliform bacteria analysis. Students in various departments will collect data for the study on livestock impacts. For example, the Biology Department may research the soil and plant types in order to determine what types of plants should be incorporated into the site during the remediation process. If pharmaceuticals are administered to the cattle, the Chemistry Department may test for the presence of pharmaceuticals in the water or soil. The Earth Science Department may participate by identifying soil types for remediation as well as testing for trace metals and orthophosphates deposited in the soil by manure. The Sociology or Psychology Departments could also play a key role in this project. It is important to look at the site from other perspectives. Interviews will be conducted with the Hoover family as well as with fishermen who use the Yellow Breeches in order to learn about the barriers to implementing best management practices and about what others who regularly use the creek think about the cattle's location. The results from research at the Land-Water Living Classroom will be used to educate ALLARM, the college and the community.

Above:Livestock entering stream in acces area.
Right: Christie Anderson monitors: at the Land Water Living

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Where Are They Now: Chesapeake Bay Executive Order

By: Shanice Grant

http://planetsave.com/2009/01/07/power-to-the-people-ii-chesapeake-bay-advocates-sue-epa/

With a shoreline of 8,000 miles, the Chesapeake Bay is North America's largest estuary (William, 2003). From the time of its formation up to this day, the Chesapeake Bay has been used for importing and exporting goods. The 64,000 square mile drainage basin of the Bay includes parts of Pennsylvania, New York, Delaware, Maryland, Virginia, West Virginia and the entire District of Columbia. Due to the various ports that are located in the Bay, the US is able to trade with countries such as Germany, Brazil, Colombia, Venezuela, Japan and more (William, 2003). The Bay has played an extensive role in the lives of many and continues to be a place of attraction. It is the livelihood of many families, and tourists from all over the nation acquire great pleasure when they come to see it. The Chesapeake Bay is a place filled with history. It is a place that many look upon for a sense of clarity. It is an ingrained part of this country but pollution entering the bay is having an adverse effect on its health.

As a variety of people have conducted research it has been found that as far back as the early twentieth century, the Chesapeake Bay has been experiencing a grueling environmental decline. The Bay has been suffering from ecological stresses due to the rapid increase in the human populations surrounding it. Not only has there been a large decrease in sea grass, finfish and other aquatic life but there have also been seasonal depletions in dissolved oxygen and increases in sedimentation, nitrogen and phosphate. (Edwards, 2010). If it continues in this fashion, the Bay's ecosystem will be destroyed. The country will lose one of its major trading ports. The people that rely on the Bay for their livelihood will lose their jobs. Many of these chemicals are being washed into the Bay by industrial discharges as well as agricultural and storm water runoff. As the situation with the Chesapeake Bay becomes worse, it is reaching the ears of many people across the nation. As the states surrounding the Bay try to find ways to efficiently clean it, they are discovering that the price of cleaning and maintaining the Bay is rapidly increasing to the point where it is costing billions and will most likely still be needing more. Due to this, the Bay Governors have proposed the problem to many officials who have the power to change the situation that Bay is currently in. A similar order was proposed during President Bush's administration but nothing was accomplished. (William, 2003). During President Barack Obama's campaign, the Bay Governors asked him to make the cleaning of the Bay of the utmost importance. President Barack Obama took office on January 20, 2009. He signed the Chesapeake Bay Executive Order on May 12, 2009, which allows the federal government to play a more prominent role in the restoration of the Bay. The government will be involved with financing and enforcing the restoration plans in hopes of returning the Bay back into what it once was.

Now as time goes on and plans for the cleaning of the Bay continue, the Chesapeake Bay Committee must consult with the states of Virginia, Maryland, Pennsylvania, West Virginia, New York, Delaware and the District of Columbia. Each of these states must establish a Total Maximum Daily Load (TMDL), meaning that each state must evaluate the pollution threshold of Bay watersheds from their region (Karl, 2009). After each state has created their TMDL, an annual progress report must be made. The committee in charge of overseeing the clean up of the Bay is still in the process of working with the various states on creating and cataloging an accurate TMDL.

"Each of us has a part to play in a new future that will benefit all of us. As we recover from this recession, the transition to clean energy has the potential to grow our economy and create millions of jobs -- but only if we accelerate that transition. Only if we seize the moment, and only if we rally together and act as one nation -- workers and entrepreneurs; scientists and citizens; the public and private sectors" (Edward, 2010). The Chesapeake Bay plays an important role in the lives of thousands and it will take the support of all these people to help clean it and make it a better place. The Committee asks that all sightings of pollution seen entering the Bay be reported to them so that necessary actions can be taken. We all benefit from the Chesapeake Bay and it is our job to help protect and conserve it.

http://engineerofknowledge.files.wordpress.com/2009/11/chesapeake-bay-region.

Map of surrounding area of Chesapeake Bay.

http://www.jamesriverassociation.org/img/choose-clean-water.jpg

Lisa Jackson annocuing the President's plan for the order.

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Eutrophication in the Chesapeake Bay and its Impact on Ecosystems and Communities

By: Ruby Stanmyer

The Chesapeake Bay, pictured on page 22, is largely developed and much of the 64,000 square mile watershed is affected by non-point source pollution. Agricultural and stormwater runoff contribute pollutants, such as nutrients and sediment, to the Bay, which adversely affects it and deteriorates the ecosystem. The two largest sources of nutrients are phosphates and nitrates, which are found in fertilizers and animal waste. Sewage treatment plants also add nutrients to the Bay.

Stratification, which is the inability of salt and freshwater to mix with each other, is a natural process that also contributes to the deterioration of the Chesapeake Bay. Sediments and pollutants from incoming rivers are pushed out into the Bay and are not given the chance to become diluted with saltwater. These contaminants are therefore not able to leave and enter the ocean where they would be less harmful to the inner Bay (Department of Natural Resources).

Nutrients are key problems, since they increase productivity of vegetation, like algae, through a process called eutrophication. When spurred by excess nutrients, algae growth is very harmful to the ecosystem. First, the new algae blocks sunlight from reaching plants that are deeper under water, causing these plants die off. The algae and other plants that were not receiving adequate sunlight begin to decompose. Decomposition is a form of bacterial respiration which requires dissolved oxygen (DO). It is a twofold effect; decomposition takes even more oxygen out of the water, which then continues to kill even more vegetation. When DO levels become too low to support most forms of life, the water becomes hypoxic. Thus, the introduction of large amounts of nutrients contributes to eutrophication which then increases hypoxia (Maryland Department of Natural Resources). Hypoxia "occurs…when oxygen concentrations fall below the level necessary to sustain most animal life." The Chesapeake Bay has a large hypoxic zone that many advocates are working to decrease. (Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, 2004).

Eutrophication also kills submerged aquatic vegetation (SAV) and other estuarine organisms, such as crabs. SAV are one of the best indicators of water quality; when they flourish, water quality is healthy, and vice versa. Patches of SAV can help filter polluted water, provide food sources for animals, provide habitat for aquatic organisms, and supply oxygen through photosynthesis (Virginia Institute of Marine Science). The decomposition of SAV contributes to further hypoxia because the process also requires oxygen. This is another piece of evidence that eutrophication is occurring (Maryland Department of Natural Resources).

The three largest areas that contribute to the Bay watershed include Pennsylvania, Maryland, and Virginia. These states all have significant land area in the watershed, a large portion of which is devoted to agriculture. This includes not only crops, but

http://upload.wikimedia.org/wikipedia/commons/9/95/Runoff_of_soil_%26_fertilizer.jpg

Agricultural runs off into streams carrying pesticides and fertilizers.

"Eutrophication" continued on page 22

Marcellus Shale Wastewater Management

By: Benjamin Mummert

http://blogs.wvgazette.com/watchdog/files/2009/07/

A Marcellus Shale drilling pad and wastewater storage pits.

Marcellus Shale gas extraction is a challenging issue in our state. Effects include habitat fragmentation, air pollution, and stream contamination. The impacts of Marcellus wastewater are especially significant. Large volumes of wastewater are generated by hydraulic fracturing, or "hydrofracking." Compared to shallow conventional wells, Marcellus unconventional gas wells involve 2-9 million gallons of water, 205,000 - 935,000 lbs. of chemical additives, 500-1000 truck trips, and cleared lands for well pads. After each frack job, millions of gallons of water saturated with salts, metals, hydrocarbons, radioactive substances, and chemicals return to the surface. This "flowback" water is considered to be one of the dominant human and environmental health hazards.

After fracking, flowback returns to the surface at extraordinary pressure. Blowouts have occurred on January 17, 2011 in state forestland in Tioga County (1) and in June, 2010 near Clearfield (2). Each blowout shot corrosive water and flammable gas for hours. The volume of flowback produced each day could cover a football field with fifty feet of contaminated water. That amount will continue to increase as more wells are drilled and some are re-fracked. The strategy embraced for disposal varies among states.

Commonly, flowback wastewater is injected deep underground (Marcellus-shale.us). Pennsylvania is the only state that allows it to be discharged to surface water. DEP has approved 18 facilities to accept Marcellus wastewater. Most dilute contaminants, instead of removing them, and can't accept much wastewater at a time. Several facilities are under construction but disposal capacity does not meet the demand.

More than a million gallons of wastewater were discharged at a treatment facility in a Philadelphia suburb despite regulations that should have kept it out of the Delaware watershed and assurances that the local communities' water was free of gas waste (AP). Companies known to have illegally and accidentally discharged wastewater amassed 100 violations of the Clean Streams Law alone between 2008 and 2010. The PA Department of Environmental Protection has made gradual progress in regulating disposal of wastewater.

In July 2010, DEP also released new guidelines for total dissolved solids (TDS) effluent levels from plants. The regulation sets an effluent standard of 500 mg/L TDS and 250 mg/L of chlorides for new discharges of natural gas wastewater.

The costs of transporting and disposing of wastewater has lately led the industry to "recycle" flowback water, by reusing it in fracking another well. How much wastewater is still being discharged into rivers is unclear (AP). Much research is still needed on the recycling of flowback water.

Range Resources

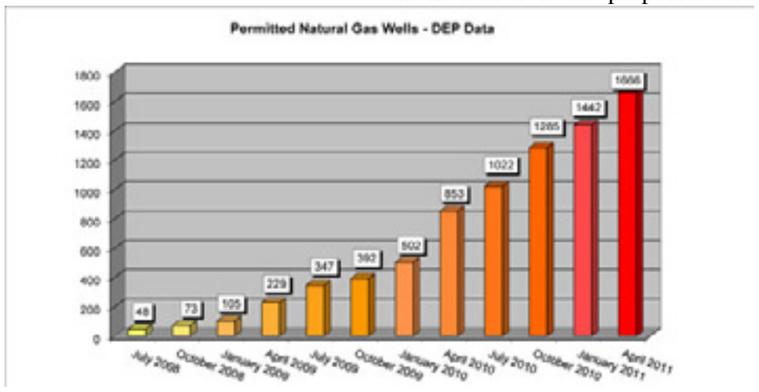
"Wastewater Management" continued on page 23

The Case Against Fast-tracked Permits

By: Kimberly Wilson

Pennsylvania is no stranger to natural resource extraction and environmental degradation. A staggering amount of Pennsylvania's state public lands, including state forests, has been leased to the oil and gas industry for natural gas play in recent years and there are no signs of scaling back. However, natural resource extraction in the past dealt with shallow sources of material and therefore current laws and regulations do not sufficiently consider the impacts of drilling into deep geologic formations. To compound this problem, the Pennsylvania Department of Environmental Protection (DEP) has increased the rate of permit issuance and stripped County Conservation Districts of their power over the review process in order to keep up with the demand for natural gas. Specifically, their role in reviewing permits for erosion and sedimentation (chapter 102) and water obstruction and encroachment (chapter 105) for oil and gas activities. The DEP has expedited a process of which they, seemingly, do not have the manpower to execute these changes. It is therefore important to understand how companies obtain permits to extract natural gas in areas purportedly protected under environmental regulation at such an unprecedented rate.

In Pennsylvania, the governing body responsible for permit issuance is the Department of Environmental Protection. Abruptly in March of 2009, the DEP issued a directive to remove permit review power from Pennsylvania County Conservation Districts and instead manages this process (Thompson 2011). Included in these provisions are all oil and gas operations, whether related to exploration or extraction. Prior to these revisions, Conservation Districts were responsible for reviewing erosion and sedimentation control general permits (ESCGP-1) in their county. ESCGP-1s are one type of permit required in the overall drilling permit, but are essential to establish best management practices for the earth-disturbance aspects of drilling and pipeline operations. It is also important to note that there is no specific permit application for drilling in Marcellus shale; the general permit can be used if the site is under five acres.



http://www.bradfordcountypa.org/Images/Gas-Map-Images/Chart-of-Permitted-Gas-Wells.jpg.
Natural gas wells permits increase in Bradford county, data until April 2011.

What is now in place is an expedited DEP permit review process, often referred to as "fast-tracked permitting." An application must be processed within fourteen days if it meets certain criteria and a state-registered engineer, surveyor, geologist or landscape architect has approved the operator's regulatory and best management practices (Szybist 2011). The result is an influx of approved drilling projects throughout the Marcellus shale region. According to the Bureau of Oil and Gas Management, a branch of the DEP, as of May 12th, 1,116 drilling permits have already been issued in the Marcellus Shale in Pennsylvania (Bureau of Oil & Gas Management 2011). Bradford County has the most issued this year with 230 general permits as of April. Since 2005, the DEP has approved 7,198 permits to drill in the Marcellus Shale (Bureau of Oil & Gas Management 2011).

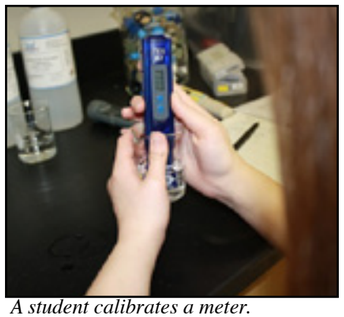
Most troubling is that companies are only required to seek an ESCGP-1 if the proposed area would have five acres of land, or more, disturbed by the well pad and relating operations (roads, water storage tanks, etc.) (Szybist 2011). In comparison, general construction activities (such as a house) disturbing more than one acre of land must apply for a specific, more stringent permit (known as the National Pollutant Discharge Elimination System, or NPDES permit) before any project begins. Under this regulation, operators can simply bypass obtaining an ESCGP-1 permit to have their erosion and

"Permits" continued on page 21

Stream of Consciousness

Landowners and Well-Water Testing

By: Abigail Breckinridge



A student calibrates a meter.

Landowners in the Marcellus Shale region should be aware that it is highly recommended that they perform periodic testing of their well water in order to determine its pre, during, and post drilling quality. The process known as hydraulic fracturing, integral to the practice of drilling for natural gas, can lead to ground and surface water contamination. Therefore, many landowners elect to send well-water samples to independent laboratories that test for possible impurities.

Testing at a laboratory can be done a la carte, meaning individual tests for particular parameters (for example, turbidity and pH, $10, and volatile organic compounds, $160). It can also be done as a tiered package (FHA- long series for $200-$275). While some of these tests may be rather expensive, they are nevertheless important. Also, many drilling companies will pay for well-water testing for homes within 1,000 feet, sometimes up to 2,000 feet of a drilling site. It is important to be informed on such drilling company practices, as well as to know what to test for. If a drilling company offers to test a landowner's drinking water, it is recommended that the landowner request a third party, non-industry related certified laboratory to conduct the testing.

Total coliforms and fecal coliforms (or E-coli) are bacteria that can cause diarrhea, dysentery, and hepatitis, and should be tested for in any well water analysis. Another important factor is pH, which, if too low (acidic), could damage pipes and cause heavy metals, like lead, to leak out of pipes. Lead poisoning can result in convulsions, major neurological damage, organ failure, coma, and ultimately death; lower levels of exposure may result in hearing loss, stunted growth, and learning disabilities in children. Nitrate should also be tested for, especially because nitrate interferes with the ability of blood to carry oxygen and can be particularly dangerous for infants under six months. VOCs are among the most dangerous contaminants and include benzene, a known human carcinogen; carbon tetrachloride, a probable human carcinogen; toluene, which affects the nervous system; trichloroethylene, which can cause kidney problems and death and methyl tertiary butyl ether (MTBE), which is a fuel additive in motor oil and can be harmful to human health. Additionally these are other recommended chemicals: barium, chloride, iron, manganese, arsenic, strontium, bromide, hardness, aluminum, and sulfate.

Homeowners should carry out baseline testing before any drilling begins ideally four times (in each season) in the year before drilling begins. However it is costly to do such extensive analysis, at a bare minimum obtaining a full suite of analysis just prior to drilling starting is recommended. Baseline drilling is important because it

"Well-water Testing" contined on page 24

http://www.moldinspect.org/sitebuildercontent/sitebuilderpictures/Well_water.jpg.

Right: Kim Wilson testing for total dissolved solids.

Posies Prevent Pollution: Rain Garden at Dickinson College

By: Cara Applestein

Imagine a sponge, full of holes and can easily be infiltrated by water. That network of tubes, and chambers also characterizes karst geology underlying Dickinson College and most of the Appalachian Valley Range from Georgia to Maine. Karst landscapes are made up of limestone and dolomite, rocks that are easily weathered especially when they come in contact with acidic rain water. As a result, holes and spaces are created in the bedrock and allow easy access for pollutants to enter into the groundwater. Good stormwater management practices are vital to prevent the movement of contaminants into groundwater and by extension, groundwater-fed streams. Large quantities of water can eat away at the porous bedrock quickly and create sinkholes. Thus, controlling the quantity of runoff that occurs after a precipitation event is also extremely important.

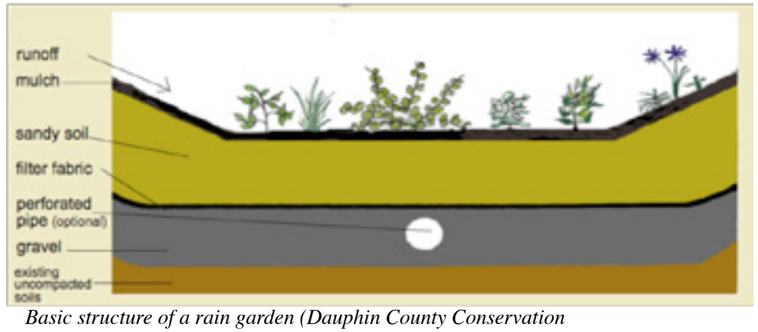
Carlisle is one area where karst geology and land use create a situation where management is needed. Urban runoff from roofs and roads, called stormwater, carries pollutants into the LeTort Spring Run through storm sewers. The cracks and holes within the limestone, under the soil, can potentially allow these chemicals to reach the groundwater faster than through other rock types. One way to control the runoff is to create a rain garden. A rain garden is a depression filled with special substrate, soil and (usually native) plants. It allows for the slow infiltration of water into the ground. Rain gardens trap pollutants, control the quantity of runoff, and recharge groundwater, which makes them important best management practices (BMPs) for areas with high impervious cover. At the same time, karst geology presents some special considerations for building a rain garden because concentrating water in a small area can weaken the bedrock. Despite this, the Pennsylvania Department of Environmental Protection still promotes infiltration methods as the best methods of managing runoff on karst, as opposed to treating stormwater in systems above the ground.

Dickinson College has embraced infiltration basins as part of its commitment to environmental responsibility. Examples have been constructed at the Rector Science Center and in the courtyard of the Quarry Café. In 2009, Evan Kendall (2012) proposed creating a rain garden beside of Kaufman Hall as part of his LUCE Integrated Watershed Semester independent research project. He concluded that the grassy area between the ALLARM office and Cherry Street was a good location for a rain garden.

Beginning last fall, ALLARM has been working with the Facilities Department to realize the idea of a rain garden next to the office. The downspout that drains the office roof is currently the only on the west side of Kaufman that flows into the storm sewer instead of infiltrating into the grass. Goals of this rain garden include reducing stormwater entering LeTort Spring Run, acting as a demonstration project for other community groups, expanding ALLARM's technical assistance capacity, and advancing the retrofit of Kaufman as a more environmentally friendly building.

Although it seems as though the Cherry Street site is a good location for the garden, there are still some concerns. The rain garden basin will need to be a third of the area of the roof, making it larger than normal. This will allow the water to spread out over a greater area. The site by Cherry Street can most likely accommodate a rain garden of this size but without any leeway. Also, a less permeable layer of substrate will be buried

"Rain Garden" continued on page 24



Basic structure of a rain garden (Dauphin County Conservation Guide.2009).

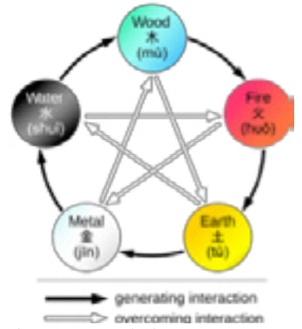
What Does Water Symbolize?

By: Wuji Zeng

Water is one of the most essential resources needed by all living beings on Earth. Because of the role it plays in the various human civilizations, water tends to serve as a symbol for worship cross-culturally. Water is generally believed to be one of the primary elements since the beginning of the cosmos and to be the source of life. Moreover, water is considered to have a purifying power, to be the seat for a god or a goddess itself, and sometimes a symbol of fortune. For example, water symbolizes different but relevant concepts in two major schools of Asian cultures, namely East Asia (China and Japan) and South Asia (i.e. India).

China— "the benevolent love mountains, and the wise love waters" —Confucius

To the Chinese, water is viewed as the "blood of the soil" (Yang 1993). In Taiji, one of the most famous Taoist symbols, water is yin and fire is yang. Yin roughly stands for passive power and femininity. This is part of the reason why Chinese think of "women as water." Ancient Chinese people and many contemporary Chinese people believe that, like water, women are gentle, hard to control, and have "unstable form", changing their mind and mood often. Moreover, water was believed to be the generating power for life. Besides this, water is one of the five primary elements called Wu Xing, or five phases, in Chinese—Wood, Fire, Earth, Metal, and Water. In the generating process, water is collected by metal while at the same time nourishing wood. On the overcoming process, earth absorbs water while water quenches fire. Another major water-related symbol is the Feng Shui, a concept also highly influential in many Asian countries such as Japan, Korea and Vietnam. For Feng Shui (literally wind-water), the goal is to find a proper placement and arrangement of space to achieve harmony with the environment (Wilhelm, 1995). Shui (water) is what helps keep the energy flowing and thus cannot be stagnant. According to this idea, water stands for luck and wealth, so working close to water is like being close to fortune.



The five elements of life "wuxing" http://en.wikipedia.org/wiki/File:Wuxing_en.svg.

A basin at a Shinto shrine. "Temizu Basin-Itsukushima Jinja" http://reference.findtarget.com/search/Shinto.

Japan—"let the water carry the past away" —An old motto

The Japanese developed their worldview and culture largely based on traditional Chinese influence. The Japanese also believe in the Wu Xing (with slight modification) and Feng Shui. The famous Japanese water garden in Western literature is an application of Feng Shui. It is an attempt to sit within nature. They also believe that water is the source of life. For example, when a miscarriage takes place, the lost embryo is said to be mizuko, the child of water. In addition, there are original Japanese views of water. In the native religion Shinto, water, like white salt, is believed to be pure and therefore is used in most of the purification rituals. When a visitor goes to a Shinto shrine, it is generally a custom to use water (usually from a cold spring) to clean the hands and mouth to wash away the uncleanness one gets in the earthly world. This kind of water is called temizu (hand-water). For some priests, standing under a waterfall for hours is believed to be a great exercise to be closer to Zen and to purify themselves.

"Symbol of Water" continued on page 18

"Symbol of Water" continued from page 17

It is believed that the cold water could refresh one's mind and body, making one mentally stronger. The purification power of water is also shown in the Japanese motto shown above, which means to forget the past and accept one's apologies. *India—"May the waters that descend from the sky or from the top of glaciers, which are derived from the earth by digging or which have been bestowed on us by the god in the form of lakes and are self evolving, those that continuously flow towards the oceans, and the ones which are themselves holy and are used for purifying everyone, bless us!" — Rigveda 7.49.1-2 (Translated by Sharma)* During a typical Indian ceremony, there is a pot kept near the entrance filled with clean water, with fresh mango or betel leaves placed at the mouth and a coconut placed on top (India Mirror, 2011). As a country with a great emphasis on ceremony, water's almost universal presence in ceremonies shows the great respect Indians pay for water. Water has been described and referred to as 'nectar', 'honey', 'source of life', 'cleanser of sins', 'generator of prosperity' and dozens of others (Sharma, 2009). The rivers were considered to be divine and worshipped as Goddesses in mythological descriptions, a dip in the holy rivers is considered an essential part of Hindu culture. Every morning and evening on the banks of Ganga at Haridwar, the daily Ganga worship takes place with lighted lamps and the presence of thousands of devotees. Purification is an essential concept in Hindu society; for many Indians, washing one's body with water is an instrument to determine the rigors of social-ritual purity (Joshi & Fawcett 2001), a great experience for self-purification and removal of the earthly wrongs. In Rigveda, an ancient Indian collection of Vedic Sanskrit hymns, it is said that "…whatever sin is found in me, whatever wrong I may have done, if I have lied or falsely sworn, Waters remove it far from me…" (Joshi & Fawcett 2001). Moreover, the respect for water also works as a deterrent against pollution as seen in the prayer mentioned in the beginning of this section. There are many similarities about the view of water between these two major cultural schools in Asia. It would also be interesting to think about whether this criterion of water also applies to Western culture. Say, for example, the use of water in a baptism. It is interesting to see that people all over the world, living in different environments, eating different food, and speaking different languages could have such a similar view on what water symbolizes.

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America's Most Endangered River of 2010: The Delaware

By: Thomas Carugati

The Delaware River by the Catskills Mountains. http://www.visitthecatskills.com/images/photos/Delaware%20River%20Fall.jpg.

In June 2010 one of the nation's leading river conservation organizations, American Rivers, named the Upper Delaware the most endangered river in the United States. The criteria for making the most endangered rivers list is not necessarily the most polluted rivers, but the ones that are threatened by potential decisions that could significantly devastate the health and sanctity of a river (American Rivers 2010). The Delaware earned the number one spot on the most endangered list due to the threat that the proposed development of natural gas extraction in the Marcellus Shale region poses on the river. Although drilling would occur predominately in the region of the upper Delaware, the middle and lower Delaware from the Delaware Water Gap to Trenton, NJ are also susceptible to harm as pollution travels downstream. New drilling technology known as hydraulic fracturing has allowed for the natural gas industry to tap into the natural gas reserves of the Marcellus Shale (American Rivers 2010). This technology requires the use of massive quantities of water, approximately between two and nine million gallons per well. As a result of the necessity for water, it is likely that drilling companies will site their wells close to waterways, leaving the Delaware and its tributaries susceptible to potentially devastating water extraction and chemical discharge practices (American Rivers 2010). If proper regulations are not put in place this may lead to significant ground and surface water contamination. The flowback water that comes back up to the surface not only contains chemicals, gels, and lubricants added to facilitate the drilling process, but significant quantities of other toxic and potentially carcinogenic material such as metals barium and strontium, which naturally occur in the rock formations (American Rivers 2010).

Natural gas drilling in the Delaware River Basin is particularly alarming because of its importance as a natural habitat and source of clean water. In fact, although the Delaware only covers 13,539 square miles, representing four-tenths of one percent of the land area of the United States, the river provides drinking water to approximately 17 million people, representing over five percent of the U.S. population (Delaware Riverkeeper 2010). These figures account for the cities of New York and Philadelphia, the nation's largest and 5th largest cities, as well as everywhere in between, as the river serves as a natural border separating Pennsylvania and New Jersey. Due to the high water quality present in the Upper Delaware, New York City is able to divert water directly from upstate reservoirs directly into the city's taps relatively unfiltered (Soraghan 2010). New York City's Mayor Michael Bloomberg has been a staunch opponent of drilling in the Delaware (Soraghan 2010).

In addition to the drinking water that the river provides, it is also home to over forty five species of fish and fifty species of mammals

"The Delaware" continued on page 20

"The Delaware" continued from page 19

that may be threatened if drilling waste is discharged into the river. This includes deer, beavers, fox, bears and bobcats which all rely on the Delaware for food and water. Because the Delaware remains undammed, the American shad and eel thrive, as well as other species such as trout and small mouth bass. Two hundred species of bird migrate or spend their entire lifecycles within the banks of the river. These include rare bird species such as the American Bald Eagle, osprey, and wild turkeys.

Thousands of people also enjoy the river for recreational purposes such as fishing, boating, and nature watching. There is fear that these activities will be compromised if drilling is not banned, or at least properly regulated. Natural gas extraction in the Delaware Basin has shed light on an interstate-federal regulatory agency known as the Delaware River Basin Commission (DRBC). The commission was founded in 1961 as part conjoining federal and state legislation to address water quality, and water management issues in the Delaware River Basin. The DRBC consists of four basin governors and the North Atlantic Division Engineer of the Army Corps of Engineers who serves as the federal representative (DRBC 2010).

Although the DRBC does not receive the same level of national media attention like an agency such as the EPA, the DRBC has enormous potential to play a significant role in the development of natural gas extraction in the Delaware River Basin. The PA and NY Department of Environmental Protection agencies may control general well permitting for well drilling, but the DRBC has legal jurisdiction over any activity that may adversely impact water quality and quantity issues of the basin (DRBC 2010). The commission's regulations are especially stringent in the area designated as Special Protection Waters (SPW) by the DRBC in 1992. This area of the Delaware extends from the headwaters in Hancock, NY all the way south to Trenton, NJ, and consists of "exceptional" water quality that exceeds most federal and state standards. The area is also highly valuable recreationally and ecologically. In this protected area, nothing may be extracted or discharged into the waterway that has a measurable impact on its quality (DRBC 2010).

http://woofish.homestead.com/Delaware_River.gif.

The Delaware River, highligted in yellow, runs along eastern Pennsylvania and western New Jersey.

On May 19, 2009 many conservationists celebrated a victory when the DRBC created legislation requiring DRBC approval for any proposed well within the area of the basin. The victory was further extended a year later on May 6, 2010 when the DRBC declared a moratorium on all natural gas production wells basin-wide. This legislation was then forced to include exploratory wells on June 14, 2010 as a result of pressure from many conservation organizations such as American Rivers and the Delaware Riverkeeper Network, claiming that they pose an equal threat to river contamination due to water extraction and flowback water. As of December 9, 2010 the DRBC has posted a set of draft drilling regulations which are open to a four-month comment period ending April 15, 2011 (DRBC Marcellus). Not everyone has been satisfied with these regulations, the Delaware Riverkeeper and Damascus Citizens for Sustainability filed suit on February 1, 2011 against the DRBC for a loophole that allows the continued operation of exploratory wells that had already been approved prior to the original 2009 legislation (Delaware Riverkeeper Network 2010).

Many consider the regulations to not adequately address the threat natural gas drilling imposes on the river. For example, the Delaware Riverkeeper Network cites several grievances of the draft regulations, such as a lack of restrictions on the types of chemicals used and lack of mandate for wastewater standards. In addition to the lack of wastewater

standards, the draft legislation does not give any additional consideration for the threat that runoff may pose on water quality relying on already weak Pennsylvania stormwater regulation from which natural gas drilling is exempt. The threat of stormwater is compounded by the distance that the draft regulations permit gas companies to site their wells; merely 500 feet from the Delaware or tributary. The Delaware Riverkeeper Network claims that 500 feet is still within many floodplains posing an immediate threat to ground and surface water and that wells should be sited at least an additional 300 ft from that (Delaware Riverkeeper 2010).

As the close of the comment period on the draft regulation approaches, it will be interesting to see what changes, if any, occur to the draft regulations. As recently as January 4, 2011, the Cabot Oil and Gas Company has trucked 44,000 barrels of wastewater to the Hatfield Township, PA wastewater treatment plant, which discharges in into a tributary of the Delaware. This was done without approval from the DRBC and there is a lack of evidence to suggest that this treatment facility was equipped with the proper technology to treat wastewater (Delaware Riverkeeper 2010). These actions show the potential threat that a loosely regulated industry may pose for sanctity of the Delaware. It is hopeful that the DRBC will continue to act on behalf of the river's best interest and make significant changes to the draft regulations if drilling continues to move forward. For now, we can only hope that the Delaware River remains a place of natural beauty and as a stable habitat for the species that depend on it.

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"Permits" continued from page 14

sedimentation plan reviewed by a certified professional by making sure their well pad is slightly under five acres. Even then numbers may not be reliable. In one area, a company may have many wells to try to extract as much natural gas as possible. Without an E&S plan, all of these sites have the potential to severely degrade streams. In addition, their cumulative effect can fragment and devastate forest ecosystems, further questioning the motives for expediting permits.

While Conservation Districts are still on the ground, their removal from the permit and review process has left them with little they can do to protect the environment in their own county. They are still called upon to field questions from the oil and gas industry, legislators, and concerned citizens; however, they have no method of compensation (Garner 2011). In one example, the DEP mining office in Susquehanna County has asked the local Conservation District to continue to vet plans for erosion and sedimentation control for drilling activities due to their own time constraints (Garner 2011). Essentially, they still do the same work but they no longer can charge a fee for their time. There is much that goes into the permitting process, and now that there is a shorter turnaround time for permit applications, the DEP will have to compensate by hiring more staff in a time of budget cuts. Instead of making it easier for the natural gas industry to exploit Pennsylvania's resources, it would be ideal for the DEP to create a permit tailored to Marcellus shale issues. Public lands should be protected with more stringent regulation and enforcement of best management practices.

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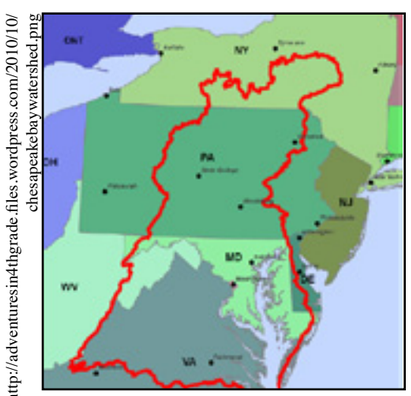
"Eutrophication" continued from page 12

livestock such as cattle, chicken, and pigs. Everything that happens on these lands affects the Chesapeake Bay in some way. Though Maryland and Virginia are closer to the Bay itself, Pennsylvania has just as big an impact, if not bigger. The Susquehanna River is responsible for 42% of the total freshwater in the Chesapeake Bay and the Susquehanna watershed encompasses a large portion of Pennsylvania (Chesapeake Bay Program). In fact, Lancaster County in PA is the most productive farming county in the United States and is the largest contributor of nutrients to the Bay (Susquehanna River Basin Commission). Farms are essential and promote healthy economies, but they are challenges regarding the eutrophication of the Chesapeake Bay. Agricultural runoff is responsible for approximately 70% of the pollutants that cause eutrophication. Fertilizers and pesticides are applied to crops and are then washed through runoff into nearby streams which lead to the Chesapeake Bay. Also, when farm animals have access to and spend time in streams, their waste adds nutrients and bacteria.



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Outline of the Chesapeake Bay Watershed.

http://salem.rutgers.edu/nre_homeowner/elmer-eutrophication-480.JPG

Eutrophication build up of algae on the surface.

There has been much progress to address problems in the Chesapeake. The new sewage treatment plant legislation was designed to lower Pennsylvania's impact by building new plants with more advanced processes to clean water before it is discharged into a stream. This is costing the state millions of dollars. However, there are practices for farming that, if legislated, could lower our impact on the Chesapeake and not cost nearly as much as the creation of new sewage plants (Maryland Department of Natural Resources).

What are possible remedies to counteract the negative impacts that farms are having?

One solution is to implement best management practices (BMPs); methods for lowering a farmer's impact. These include applying fertilizers and pesticides properly and keeping cattle and other animals out of waterways. The latter can be accomplished by fencing and creating alternative water and shade sources. It is also important to prevent potential harmful runoff from reaching streams to reduce the amount of pollution that reaches the Chesapeake Bay in the end. Techniques for doing this include creating or improving riparian buffers that help filter pollutants before they reach the water, building litter stacking sheds, and creating farm ponds to catch runoff (Chesapeake Bay Program). Implementing best management practices would reduce almost two thirds of the current levels of nitrogen and phosphorous levels necessary to restore the Bay and could be accomplished at 13% of the previously estimated total cost of restoration (Chesapeake Bay Foundation). A separate study revealed that through improving agricultural practices, every $1.00 of state and/or federal funding spent on the project would result in $1.56 in economic activity in Virginia (University of Virginia Study on Sustainable Agriculture).

The Chesapeake Bay provides food and jobs for thousands of people. The seafood industry in Maryland and Virginia alone totals $2 billion in sales and over 41,000 jobs to local people (NOAA 2008. 2008 Fisheries Economics of the U.S). It has also been estimated that in total, the Chesapeake Bay is worth over $1 trillion – thanks to fishing, tourism, property values, and shipping activities. Pollution in the Bay will lead to further economic losses as fish, crabs, oysters, and other valuable organisms that continue to die (Chesapeake Bay Foundation). Between 1994 and 2004, the value of the seafood harvest in Virginia decreased by 30%. Jobs have therefore decreased in Virginia, as well as in Maryland. The decline in crabs alone has had a massive impact on the Bay; the number of crabs has dropped from 276 million in 1990, to 131 million in 2008. If you add up all the possible impacts of this decline, Maryland and Virginia have lost a total of $640 million between 1998 and 2006 (Chesapeake Bay Foundation Report).

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Farm runoff picture: http://www.flickr.com/photos/48722974@N07/sets/72157623708793466/detail/.

Stream of Consciousness

"Wastewater Management" continued from page 13

claims it reuses 100% of flowback through "clarification" which requires transport to a facility where it is mixed with more chemicals to settle out some contaminants, not including the salts. That clarified water is then transported to another site, diluted with freshwater, and used for fracking the next well.

Other companies have needed to remove salts, also called brine, to reuse flowback for the fracking process. Integrated Water Technologies, Aqua-pure and General Electric are developing technologies to separate cleaner water from brine, including mobile evaporation and crystallization units (Marcellus coalition, 3). For now, however, most of the water must be trucked to and from stationary facilities.

While "recycling" can connect to savings of money, traffic, withdrawals and wastewater treatment burdens, it has costs. For one, it is unclear how industry disposes of all the concentrated contaminants in clarification sludge and the briny slurry from treatment. Also, recycling requires flowback be stored in huge wastewater pits, which are vulnerable to leaks. The manager of the Oil and Gas program at DEP's Southwest Region Office called leaking pits the most serious issue DEP has encountered and encourages citizens to make reports. Pits smell like sewage, contribute to air pollution, and disfigure landscapes. Wildlife and livestock have died after drinking the stored water. In some cases, pit sludge and liners have been buried instead of removed during "remediation."

Drilling for natural gas in the Marcellus Shale is a multi-faceted issue with a lot of considerations, regulation, and research needed to inform decisions being made.

A wastewater treatment discharge point.

Five Dickinson College students worked together with Professor Simona Perry to put together a Community Impact Assessment (environmental and social) of roads and traffic from gas development in Bradford County.

Sources

1.(http://www.theithacajournal.com/article/20110125/NEWS01/101250370/Pa-fracking-blowout-spews-fluid-onto-state-forest-lands)

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3.(http://themarcellusshale.com/2011/01/21/treat-frac-water-for-the-natural-gas-industry/)

4.(Marcellus-shale.us)

"Well-water Testing" continued from page 15

gives grounds for a comparison between original and new values; this information can be given to the Department of Environmental Protection and may be used in cases against drilling companies. Wells should be checked once every spring to make sure there are no mechanical problems, and they should be tested once a year for fecal coliform, nitrates, total dissolved solids, barium, strontium, methane, and pH. Shallow wells and surface water supplies need to be tested more often.

For more information check out:

1)Water testing laboratories in PA: http://www.hotfrog.com/Products/Water-Testing-Laboratory/PA

2)Wilkes University Testing Options: http://wilkes.edu/pages/4198.asp

3) Penn State's Marcellus Shale Extension: http://extension.psu.edu/water/marcellus-shale

4)Rules and regulations: http://water.epa.gov/lawsregs/rulesregs/sdwa/currentregulations.cfm

5)Contaminants: http://water.epa.gov/drink/contaminants/index.cfm

6) What you need to know about well-water testing: http://water.epa.gov/drink/guide/index.cfm

7)Get involved: http://water.epa.gov/action/protect/index.cfm

8)Tools and technical assistance: http://water.epa.gov/infrastructure/watersecurity/techtools/index.cfm

9)Non-governmental organizations links: http://water.epa.gov/infrastructure/drinkingwater/sourcewater/protection/nonepaorganizationslinks.cfm

10)Private drinking water wells: http://water.epa.gov/drink/info/well/index.cfm

Water Quality Testing: Tiers

Testing Option # 1
This option is recommended as a screening for post gas development or screening for wells that are in low risk areas. (Low risk areas are areas were there is no industrial development, no known sources of contamination or contamination events, or areas not currently leased for natural gas or oil development or if you want to see if there has been a significant change in water quality from the original baseline.

Total coliform with E. coli. confirmation, chloride, sodium, barium, pH, total dissolved solids, surfactants (MBAS), iron, manganese, and methane/ethane- estimated cost based on a survey of certified laboratories is about $ 300 to $375 per sample.

Testing Option # 2
Based on recommendations of the PA Department of Environmental Protection and a review of available flowback water and frac water data. This testing option would be the minimum listing of parameters if you are in an area that has been leased or there are known sources of contamination from road salt and gasoline/oil leaks.

Parameters listed in Option # 1, plus Total Hardness , Strontium, Conductivity, Alkalinity, Arsenic, Nitrate, Total Suspended Solids, Sulfate, Oil & Grease, Bromide, and 21-VOCs (volatile organic compounds) /MTBE (methyl tertiary butyl ether)- $575 to $675 per sample.

Testing Option # 3
More Comprehensive- Assuming the wells are outside 1000 feet of a well site, but an area active with Marcellus Shale Related Activities.

Parameters listed in Option # 1 and Option # 2, plus Selenium, Potassium, Sulfide, Ammonia, Acidity, Nickel, Gross Alpha/Beta, Lead, and Uranium - estimated cost based on a survey of laboratories is about $800 to $975 per sample.
Source: Wilkes University, http://wilkes.edu/pages/4198.asp

"Rain Garden" continued from page 16

below more porous layers in the rain garden so that the basin will store stormwater as well as filter it. Additionally, ALLARM will consider including limestone pea-gravel or lime to neutralize water that might otherwise dissolve the bedrock. A rain barrel will capture and store rain to water plants during dry times.

ALLARM and Facilities intend to include plants recommended by Evan Kendall in his project. These include blue verbena, foxglove beardtongue, marsh mallow, rush aster, butterfly weed and many more. The project is currently in the planning stages. However, ALLARM and Facilities hope to break ground in 2012.

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Stream of Consciousness

"Emap and eNotice" continued from page 7

pad location through eMapPA.

I discovered that I received drilling pad application-related notifications at each stage of the approval process, allowing me to track the progress of each individual pad's application approval. This indicated that it was indeed possible for monitors to know the location of where a drilling pad would be from the company's permit submission. I then set to develop a document that would visually demonstrate to volunteers how to sign up for and use eNotice and eMapPA.

In the following weeks, I produced a Word document with visuals for each step of the process: from registration, to understanding the tools, to locating the drilling sites and other utilities on a map (found at: http://www.dickinson.edu/uploadedFiles/about/sustainability/allarm/content/Well%20Permits_eNotice.pdf). The opportunity to work on a project that I knew people were waiting for was strongly motivating. After the actual document was finalized, I had the opportunity to deliver a PowerPoint presentation illustrating how to use eMapPA and eNotice at ALLARM's first Marcellus Shale monitoring workshop. I additionally was allowed to participate in meetings between other organizations, such as Trout Unlimited. Being able to see first-hand the interest in and necessity of the work I had completed was incredibly rewarding. The overall response to ALLARM's monitoring protocol was heartwarming. Attendees of the first workshop responded that they were "grateful" for the invaluable information and described the information as "what they had tried to find, but were unable to."

Within the past year, the interest in Marcellus Shale-related issues has exploded, and interest in monitoring techniques has followed suit. The number of shale-related workshops has risen, as well as the breadth of Pennsylvania locations that have indicated an interest in ALLARM's protocol. As a result, ALLARM has devoted a substantial portion of its resources and energy to training and improving upon their monitoring protocol.

The ALLARM staff 2010-2011

Front Row (from left): Tom Carugati ('11), G Tiarachristie ('13), Kim Wilson ('11), Taylor Wilmot ('13), Cara Applestein ('11), Virginia Farley ('13), Science Director Candie Wilderman, Shanice Grant ('14)
Back Row (from left): Katie Tomsho ('12), Courtney Blinkhorn ('13), Christie Anderson ('13), Director Julie Vastine, Ruby Stanmyer ('13), Abi Breckinridge ('11), Benjamin Mummert ('12), Wuji Zeng ('12)
To Right: Assistant Director Jinnie Woodward

A Year in Review

Virginia Farley (‘13), Kim Wilson (‘11), G Tiarachristie (‘13), Abi Breckinridge (‘11), Katie Tomsho (‘12), and Christie Anderson (‘13) spend time with some of the volunteers at the LeTort Service Day.

Christie Anderson (‘13), Ruby Stanmyer (‘13), and Courtney Blinkhorn (‘13) prepare for a Marcellus Shale workshop.

Taylor Wilmot (‘13) discusses site location at a Marcellus Shale workshop.

A Year in Review

Christie Anderson (‘13) helps weed at the LeTort Service Day held at LeTort Park.

Shanice Grant (‘14) and Virginia Farley (‘13) bond after an environmental education Bug Party.

Abi Breckinridge (‘11) works on a display for a Marcellus Shale environmental education activity.

Benjamin Mummert ('12) and director Julie Vastine help with mulching at the LeTort Service Day.

Shanice Grant ('14) and G Tiarachristie ('13) collect macroinvertebrates for an environmental education activity.

Ruby Stanmyer ('13), Taylor Wilmot ('13), Christie Anderson ('13), G Tiarachristie ('13), and Virginia Farley ('13) chat with assistant director Jinnie Woodward.

Stream of Consciousness

G Tiarachristie ('13), Christie Anderson ('13), and Wuji Zeng ('12) prepare binders for a Marcellus Shale workshop.

Ruby Stanmyer ('13) lays mulch around a tree at the LeTort Service Day.

Tom Carugati ('11) helps distribute rain barrels at a rain barrel workshop.

A Year in Review

Taylor Wilmot ('13) takes a break during ALLARM's first rain barrell workshop.

Virginia Farley ('13) teaches elementary school students about wetlands during an environmental education event.

Cara Applestein ('11) helps teach volunteers how to use a meter at a Marcellus Shale workshop.

Christie Anderson ('13), Katie Tomsho ('12), and Ruby Stanmyer ('13) goof off after a Marcellus Shale workshop.

Words of Wisdom From Our Graduating Seniors

Cara

Technical assistance does not really mean much when you just hear the word until you see fishermen, landowners, and young activists sitting around a table, choosing where to take samples on a map. Or until you hear stories about people who see their streams turn strange colors. Or until your refrigerator is completely full of water samples from those who are concerned about the impact of Marcellus Shale on their backyard streams. More than anything, ALLARM has convinced me that science is not just an elusive resource for the elite but something that can be used to empower anyone, if they are given the right tools. As I prepare to leave Dickinson, I will take with me the knowledge that anyone can make a difference. I want to continue to help empower communities that want to know what they are being exposed to, what is in their water, their soils, and their forests. I am thankful that I have received a solid background from ALLARM to be able to carry out this goal.

"More than anything, ALLARM has convinced me that science is not just an elusive resource for the elite but something that can be used to empower anyone, if they are just given the right tools."

Tom

Reflecting on my time at ALLARM, I'm often stunned at the amount of valuable experiences and skills that I have developed over the course of just one year. My experience has been a unique one, due to the fact that I have only spent one year at this organization compared to the other seniors. Despite my short time at the organization I feel as though I'm graduating Dickinson with a strong set of valuable professional and leadership skills that I can largely attribute to my work at ALLARM over this past year. Working with ALLARM as a senior was a particularly rewarding experience as it provided me with valuable time management skills, simultaneously facing all the pressures as a senior at Dickinson. Through my work at ALLARM I have had the opportunity to lead, as part of a greater team, several public outreach events and workshops that empower community members with knowledge of critical issues that impact our state's treasured waterways every day. The community can then take this knowledge and apply it to their everyday lives by adopting more sustainable practices or even by merely passing this knowledge on to other community members so that they can potentially make a positive difference in our environment. To see this process happening first hand, and being a critical part of its implementation has really been the most rewarding experience at ALLARM for me in this past year for which I'm most grateful.

"Working with ALLARM as a senior was a particularly rewarding experience as it provided me with valuable time management skills, simultaneously facing all the pressures as a senior at Dickinson."

Kim

I could not imagine my time here at Dickinson without ALLARM. I have worn many hats here and proven my flexibility and capacity to complete whatever task is at hand. During my two years working at ALLARM I have represented the organization at conferences, presented at countless workshops and trainings, educated citizens about the effects of stormwater on the LeTort and provided technical assistance to watershed groups all over Pennsylvania through working in the lab. These are skills that will prove beneficial in whatever may come next for me in life post-graduation. However, it was getting to know the rest of the staff both during and outside of work that was the best part of my ALLARM experience. Whether through long drives to workshops, manual labor at LeTort Service Day or bonding over the frustration of low-range nitrates, I felt that I had a home here among my peers. I am going to miss my fellow ALLARMies!

"I could not imagine my time here at Dickinson without ALLARM."

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ALLARM, founded in 1986, is a project of the Dickinson College Environmental Studies Department. Our team of students, professional staff and faculty provides community groups with comprehensive technical support for locally-driven watershed assessments, protection and restoration. For more information visit our website: www.dickinson.edu/allarm. Stream of Consciousness is published thanks to the generous support of the Charles Merrill Kurtz Fund, established by Betty Puzak in memory of her father Charles M. Kurtz, Dickinson Class of 1907.