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WATERWORKS EDUCATION INTIATIVE

An Interactive Qualifying Project Report

submitted to the Faculty

of the

WORCESTER POLYTECHNIC INSTITUTE

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

by

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1. education
2. community service
3. teaching

Abstract

The Water Works program was designed to assess the ability of a middle school service learning project to educate and bring about changes in the community regarding local water quality issues. The program consisted of three participants; The Seven Hills Charter school, the Massachusetts Audubon Society, and Worcester Polytechnic Institute. Community education events and the design of a web site were used in the effort to educate the community. The program was adapted to include a web site dedicated to providing the information needed to start such a program in other communities.

Acknowledgements

We, the Interactive Qualifying Project team, would like to thank the following people for their assistance and support.

Community Resource Director, Seven Hills Charter School, Paulette M. Lacoste for her patience and her mediator skills. Natural History Instructor, Mass Audubon Society, Kristin Daley for her support and assistance with the after school program at the Seven Hills Charter School. Worcester Polytechnic Institute Web Coordinator, Amy Marr for all her assistance and providing us with the web page site location. The Tufts Wildlife Management team, Chenoa Lencewicz and Marjorie Winemiller for assistance with code for our survey.

Finally, our advisors, Dr. Jill Rulfs and Dr. Phillip Robakiewicz for their patience, support, understanding, and being there for assistance whenever needed.

Table of Contents

Chapter 1: Background

Service Learning

The project outlined in the grant that we participated in was a service learning project. Service learning combines service to the community with student learning in a way that improves both the student and the community (www.nationalservice.org/learn/about/service_learning.html). Service learning is a method by which students learn and develop through active participation in thoughtfully organized service that meets community needs. In addition, a service learning program is expected to provide structured time for participants to reflect on what has been done. A set number of participants, and community service hours are also important elements of such a program. The goals of a service learning program are to (1) encourage teachers of elementary and secondary school age youths to create, develop, and offer service learning opportunities for their students; (2) to educate these teachers about service learning and how to incorporate service learning into the classrooms to enhance academic learning; (3) coordinate the work of adult volunteers in school; (4) to introduce young people to a broad range of careers and expose them to further education and training; (5) hire service learning coordinators to assist with identifying community partners and implementing school-based service learning programs; (6) provide technical assistance and information to facilitate the training of teachers to use service learning in their classrooms; and (7) assist local partnerships in the planning, development, and execution of service learning projects. In addition to these goals, each individual project must have their own goals to accomplish. Service learning has been shown to improve grades, increase attendance, help youth develop practical skills, self-esteem and develop personal, social, and civic responsibility (national service web site).

The Water Works program was a service learning program. It is part of the National Service "Learn and Serve America" program. Nearly one million youth are engaged in the Learn and Serve program in the areas of education, public safety, the environment, and human needs (national service web site). The Water Works program was of the environmental type. The students were provided with information about water pollution problems and solutions and were going to relay this information to the community through some of the activities suggested in our web site. Predicted outcomes include positive water-use changes in the community as a result of the dissemination of this information.

Community Needs

The city of Worcester, Massachusetts where the Water works program was conducted is a perfect example of what the program was designed for. The city has an urban environment where water conservation and other environmental issues can easily seem distant. There are three watersheds comprising the headwaters of the major river of the area, the Blackstone River (See Appendix A). Perhaps because of public detachment from the problem that exists, water pollution problems are present both now and historically. The degree of pollution of the Blackstone was so great at one point that the river was thought to have caused outbreaks of diseases. Despite current efforts to clean

the watershed, ongoing education to maintain public awareness and raise public accountability is needed to keep it clean. The community itself stands to benefit by becoming aware of the problems of water pollution and is then in a position to make informed decisions about its water use habits, hopefully exacting a real, immediate change on the local and therefore global watershed.

Chapter 2: Introduction

The role of the WPI team in the water works program was focused mainly on assessment of outcomes and dissemination of information. The program was funded by a grant, from the Massachusetts Service Alliance. The grant is specifically written for and designed as a collaborative effort of WPI, a local Charter School group of 6,7, and 8th graders, and the Massachusetts Audubon Society who provided water conservation education. The program outlined in the grant is general and adaptable to any school with the time and resources. It is especially useful to schools that have community service requirements. Our initial goal was to work with students in the program to design a web site containing water quality and educational information that could be viewed by the general public. The web site educational material was to be provided by the students. The site was also proposed as an evaluation instrument that would use quizzes and surveys to assess the effectiveness of the site as an educational tool. Eventually, our role was redefined, to focus on designing a web site that would enable teachers all across the country to educate themselves and run a program to educate the community around them.

Using Water Works as a model system, the components of both student and community education are illustrated and available for direct use or as a prototype for the development of other service learning programs in public schools.

Chapter 3: The Program

The Water Works program

The Water Works program is a service learning program (see Chapter 1) involving the Massachusetts Audubon Society, the Seven Hills Charter School, and a Worcester Polytechnic Institute IQP team. The program was primarily designed to address water quality issues but more specifically to educate urban children who are often removed from conservation issues and from nature and use them as educators for the community. This would both reinforce their learning about environmental water quality issues and potentially have an impact on a larger community, including their families, school, and neighborhoods. Worcester Massachusetts, where the program was carried out, is a good example of the type of community that stands to benefit from the success of the program. Worcester contains three watersheds, which comprise the Blackstone River and Canal, and are good examples of the negative impact an urban community can have on water quality. As participants in the community education effort, individuals in the school and the community will be able to make informed decisions about water use and

attain an understanding that the things they do affect the quality of water from the tap to the ocean.

Program Design

The grant for the Water Works program outlines the role of the participants at the Seven Hills Charter School. The students participated once a week after school, alternating weeks, at the school or out in the field taking samples. Once a month the students went on field trips. The intention of these aspects of the program was to maintain student interest through a more hands on approach.

As stated in the very definition of service learning both a hands-on approach to education and reflection are essential parts of the program. The Water Works program provides this through frequent field trips to local bodies of water, water testing, use of models and skits in the classroom, and 45min/week allotted for reflection, with help from us in the area of the web site. The web site was designed to provide an active form of reflection. Designing information for the web site would allow students to reflect on not only what they had learned, but what they thought other people should know about water quality and water use issues. Discussion of these concepts with the IQP web designers would provide an additional level of student reinforcement, as well as providing quality control information included on the site. Since the WPI team included a civil engineer, a biologist, and a chemist, information review and reinforcement for the students would be ongoing as web site development progressed.

Included in the grant proposal were possible methods of disseminating the information to the public through community service, a goal of the program. Community education days were planned to take place at the Seven Hills School, the Audubon Society's Broad Meadow Brook Education Center and Wildlife Sanctuary, and at WPI project presentation day. More directly, students planned to take part in an effort to stencil storm drains as to the body of water that they drain into, and an Earth Day community clean up. These were just some of the planned activities and do not encompass the full range of the potential of the program to effect the community in the long term.

Role of the IQP team

The basis of the WPI Interactive Qualifying Project, or IQP, is assessing the impact of science or technology on societal structures and values. Our role, as the IQP team, in this project had a three part focus; helping in the classroom and field activities, assessing the progress and outcome of the project through questionnaires, and quizzes, and designing an accessible web site. The first part focused on participation in the student's learning and getting feedback and information for the web site. A quiz taken by the students at the beginning and planned at the end of the program was expected to gage the impact of the program on the students themselves, their water use habits and knowledge about water conservation issues (see Appendix C). The information was to be collected in an ongoing effort, helping judge the project performance while it was in progress. In this way the program could be fine tuned to keep the students interested and

the program on track. The web site was intended to help the spread of the information through the network of schools that Seven Hills is a part of. We were to design the site and assist the students in updating the site with things such as water quality data and the reflections of the students to what they learned. Statistical analysis and evaluation of the program was organized as part of our IQP presentation to the WPI community. Over time, the role of the IQP team was redefined. Weekly student interaction and active program participation was terminated about midway through the project and the IQP focused on development of the Water Works site as a model system for service learning and public education.

Chapter 4: Procedure & Contents

Method

From the outset of our project we started designing a web page containing the information given to us by the students at the Seven Hills Charter School. Our initial involvement served as an example when designing a universal system, after some programmatic changes were made (see Chapter 6), and was used as an example on the web site (see Chapter 5). On our site we had statistical information about the group involved, schedule of field trips and community education activities, water quality information, to educate the reader, and specific data about the bodies of water in and around Worcester. There was a genuine sense the project was effective, through the concern of the students about water quality issues (see web site www.wpi.edu/Projects/IQP or Appendix D) but, due to changes in the active involvement described above we were unable to gather final statistical information at the conclusion of the program.

When our project was redefined our project team used the page we had already started as a sample on a new web site. On the new page we tried to focus specifically on implementation of a similar proposal to the one we worked under at Seven Hills Charter School. Suggestions were made, not making anything too rigid, allowing a level of flexibility which would allow the model to be used in most schools. We downplayed the college element of the program to designing the web site, assessment being less important, and making the main participants be the school itself and a conservation group with resources to teach water quality awareness to the participants. We kept ideas basic enough so that it would be possible to run this program with varying age groups, group sizes, budgets, and the availability of assistance from conservation groups. Included were suggestions about possible community education pieces, some of which were tried at the Seven Hills School and some of which were designed for the web site. We tried to include different methods of community education pieces based on the schools budget for the project.

Contents

Other attributes of the new web site were background information. We tried to relay water quality scientific data, mainly to educate the person trying to run the program. This data was also intended to gage the impact of water pollution in their community. Any water

testing done in the project would be comparable and the concept of water pollution would really hit home when the problem is local.

The web site we designed was made to include material from the Seven Hills Charter School project. We hoped that the web page that we had started would serve as an example. We used water-testing data, provided by the students, their field-trip schedule, and the results of their quiz at the start of their program. This information provides insight as to what the program entails. We wanted this information to be used to structure a similar program elsewhere and the fact that we included some of the more important information would show what should be stressed in the project itself. The material may also remind educators of the importance of keeping the project interesting to those involved, with hands-on activities.

Technical Information

The main technical aspect of this project was the creation and maintenance of a web-site. Originally this site was to be the "front" of the Water Works project at Seven Hills School. However, when the project was changed, the web site became the basis for the model program developed from the original grant. The web site was hosted on the main system at WPI located at http://www.wpi.edu/Projects/IQP. The space was provided for the project by Amy Marr, the Web Master at WPI. Access to the files behind the site was given to all members of the IQP team, and the site was available for as long as the project continued.

Due to the change in the project, the web site was designed twice, each time with a different focus. The first design was a site for the middle school aged students to enjoy and use. Given this focal point, the site was designed to be easily browsed and with graphics they would enjoy. Also, another portion of the project was the community education aspect. Due to this, the web site also featured informational pages with internal links to jump from section to section within the site.

When the project changed, the web site had new requirements. A new front page was added to be more formal and aimed at professionals who might use the program. The other major change was the necessity of a survey to evaluate the effectiveness of our new web page. This survey allowed people from anywhere to evaluate the program and send comments to the IQP team.

All of the pages on the web site were created in one of two ways. Either the page was completely hand coded by the IQP team, or the page was typed into Microsoft Word as it should look on the web site, and then converted into a .html file. The second method also involved some coding effort since the page was not always correctly transferred from a .doc to a .html file properly. This process caused problems with objects being out of alignment and font not always working correctly (see Appendix B). Some debugging help was provided by on-line html code libraries (http://vzone.virgin.net/sizzling.jalfrezi) and by looking at the source code for the Tufts Wildlife Management IQP team web site (www.WPI.EDU/Projects/Tufts). The files needed for the web site are accessible to the IQP team through either a text editor in their UNIX accounts or using an ftp client to transfer the files locally and edit them using Microsoft Word or Notepad.

The major coding part of the entire web site was the survey page. This page was a key to the project because it became our main source of feedback for evaluating this project. This page was roughly based on the Tufts Wildlife Management IQP web site

survey. The survey asked for input on both the structure of the model system and the aesthetics of the web page.

Chapter 5: Results and Conclusions

Results

At the time of this writing the web page had been visited over 150 times, and we had six sets of survey data (see Appendix C). Our results therefore are comprised of the web page (www.wpi.edu/Projects/IQP or Appendix D) and feedback about our web site. The survey data is our most insightful tool for looking at the effectiveness of our web site as an education piece.

Conclusions

Assessment of our web site was difficult, due to limited feedback, but we were able to conclude several points that are insightful as to the effect of several methods we tried and the usefulness of the web site. Judging from the number of web site visits versus the number of people who filled out the survey, we would conclude that the majority of the people who visited the site were either students involved in Water Works or people we asked to fill out the survey. Looking at survey data we can conclude that either people were unwilling to look up information on the site to answer survey questions or they had trouble finding it. The comments suggest that those who filled out the survey thought that the page lacked some organization and was at times hard to read, which was later fixed. It is also quite likely that people didn't want to take ten minutes out of their day to look up the information. The answers to the questions that gage the impact of the individual on the environment are a little inconclusive because the answers are probably based on outside knowledge and were not looked up on the site. The web site assessment gave us mixed results, but it did let us know the strong and weak points of the web site. We feel that assessment of the original Water Works program participants would be more valuable and easier to draw conclusions from. Programmatic changes and time limitations damaged our ability to gage the impact of technology on society, the purpose of an IQP, because we did not get data from those who were primarily and originally involved in the program. What we ended up with was data about how useful our site was for someone who wanted to do a Water Works style service learning program in their school. Most of those surveyed said that if they were going to run a program like this they would use the site, and we feel that speaks for itself and gives us a sense that the page is useful in starting a service learning program, and that is what it was designed to do.

Chapter 6: Discussion

Program changes

The project as stipulated by the grant failed to work for several reasons and we were forced to redefine our IQP project, our position in the Water Works project, and our methods of evaluation. Early on changes in the development of the web site were made because of incompatibility of the Seven Hills School's computers with the WPI computer network. It was decided that the web site would reside on the WPI computer network and we would update with material provided by the participating students. Unfortunately for the program, this was just a beginning of the changes that would be made before our IQP could continue.

Due to circumstances beyond our control we, the IQP team, were forced to withdraw from the Water Works program. Our new role was completely different and unaffiliated with either the Massachusetts Audubon Society or the Seven Hills Charter School. In our new project we attempted to use our experience with the Water Works project to construct a model by which such a program could be run in other schools. We had two main goals; construction of a web site providing material necessary for the construction of a community based service learning project about water conservation and evaluating the model and information provided as a teaching tool. The evaluation that was an essential part of the grant and our responsibility in the project was changed as well. The grant called for surveys given to the students and participants in an attempt to gage the impact of the program on the community. The evaluation would now be a survey on the web site designed to assess the effectiveness of our new web site as an education piece, and the amount of visits to our site would be insightful as well. We used this information to see if our web site was useful in terms of both educating the viewer and as a guide to improving our service learning water quality program model.

Reflections and Suggestions

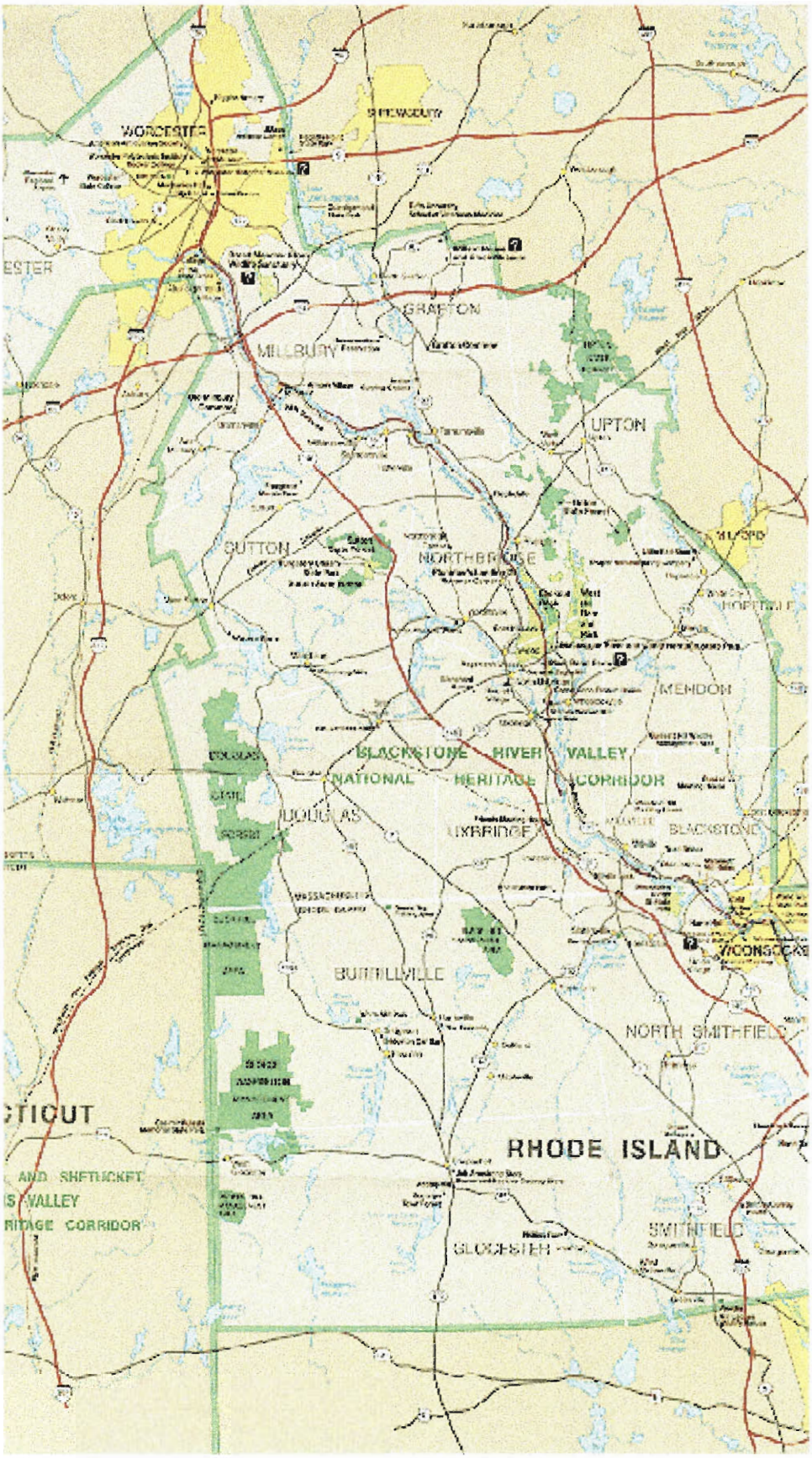
We feel that there were several shortcomings in the program. Over the time that we participated in the Water Works program several problems came to light. There was one technical problem; the WPI and Seven Hills School computers were not compatible. It was decided that the web page would reside on the WPI web server and the participants would give us materials to put on the web site. Due to a breakdown in communication and a lack of purpose in the program we were forced to redefine our role. We feel that the project would have been much more successful if the grant had been followed. For any future service learning projects we suggest that monthly meetings be held with all parties spoken for. It is also a good idea that roles are defined and understood, and bounds are not overstepped. There is a real danger of the IQP role becoming purely secretarial and that is not consistent with the meaning of an IQP so that is to be avoided as well.

The assessment aspect of the new web page is also an area we feel needs to be discussed. We feel that it is difficult to get people to take the time to fill out a web survey, not to mention just getting them to go to the web site. Many of the students involved may have access to the web but the amount of time spent by adults in the community on the web is probably minimal and that is a factor in getting concrete assessment of the community impact. For future work we hope that the program will allow for written surveying of the students and

those who attended the community education events, a more direct and a better method for finding out if education has taken place.

Appendix
A

A Map of the Blackstone River Watershed


WORCESTER
GRAFTON
MILLBURY
UPTON
SUTTON
NORTHBRIDGE
MENDON
BLACKSTONE RIVER VALLEY
NATIONAL HERITAGE CORRIDOR
DOUGLAS
UXBRIDGE
BLACKSTONE
WOONSOCKET
BURRILLVILLE
NORTH SMITHFIELD
RHODE ISLAND
SMITHFIELD
GLOCESTER

Appendix
B

The Web Page Code

(Documents are listed in alphabetical order, not in order of appearance)

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Water Works?</center></u></b></P>


</FONT><FONT SIZE=4><center><P>Abstract:</P></center>
<P></B></FONT>Water Works is a collaborative effort of the Seven Hills
Charter School, an independent public school in Worcester; the Massachusetts Audubon
Society, the largest conservation organization in New England; and Worcester
Polytechnic Institute, the nation's third oldest private college of engineering and science.
It is a community based community service program targeting the urban community
associated with the charter school. Through field and classroom learning, tangible service
activities and community education, the project will increase community awareness of
local issues of water quality and conservation.  Participation will establish current and
historical links between local behaviors and larger environmental outcomes.  Stenciling
of storm drains and involvement in Earth-Day clean up will provide concrete evidence of
student impact on the community.  Student lead community education seminars and
development of a Waterworks web site will empower the participants to effect changes in
their immediate community which will improve the environment.</P></BODY>
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OFFICE\OFFICE\html.dot">
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</B></FONT><P>Weather Conditions</U>&#9;&#9;&#9;
(Worcester)</P>
<P>Temperature: 48<FONT FACE="Symbol">°</FONT> F</P>
<P>Partly Cloudy</P>
<U><P>&#9;&#9;&#9;</P>
</U><P>Date: 11/14/98</P>
<P>Time: 11:00 to 11:30 a.m.</P>
<P> </P>
<P> </P>
<p>For more information about what this data means, look <a
href="./WQ.html">HERE</a>.
<U><P>pH facts</U>- the pH determines for how long and how many creatures or
plants can live in that area at that time. The pH test that we have done is very similar to
the tests you do with your pool.</P>
<P>pH results for Beaver Brook: 6.25</P>
<U><P>Dissolved Oxygen</U> or D.O. results for Beaver Brook: 11 milligrams per liter
of water.</P>
<U><P>Nitrate facts</U>- Nitrate can come from fertilizers, dog/animal droppings, or
leaking septic systems. When these things reach water it causes the plants in that area to
grow <I>too</I> much and decompose which takes a lot of oxygen.</P>
<P>Nitrate results for Beaver Brook: 0 Nitrate, which is very good.</P>
<U><P>Temperature of Beaver Brook</U>: 44<FONT FACE="Symbol">°</FONT> F
or 6.6<FONT FACE="Symbol">°</FONT> C</P></BODY>
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<p><b>Click on the Links to learn more about the different
topics!!!!</b></p>
<br>
<b><a href="./WQ.html">Importance of Water Quality</a></b> -Click here
to learn what problems are caused by different types of pollution!
<hr>
<a href="./index2.html">BACK</a>
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Grant</a></u></b><br>


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href=#development>Development</a>,<a
href=#evaluation>Evaluation</a>,<a
href=#organization>Organization</a>,<a href=#assets>Community
Assets</a>
<B><FONT FACE="Helvetica,Arial"><P><a
name="abstract">Abstract</a></B>:</P>
<P>&#9;<I>WaterWorks</I> is a collaborative effort of the Seven Hills Charter School,
an independent public school in Worcester; the Massachusetts Audubon Society, the
largest conservation organization in New England; and Worcester Polytechnic Institute,
the nation's third oldest private college of engineering and science. It is a community
based, community service program, targeting the urban community associated with the
charter school. Through field and classroom learning, tangible service activities and
community education, the project will increase community awareness of local issues of
water quality and conservation. Participation will establish current and historical links
between local behaviors and larger environmental outcomes. Stenciling of storm drains
and involvement in Earth Day clean-up will provide concrete evidence of student impact
on the community. Student lead community education seminars and development of a
<I>Waterworks</I> web site will empower the participants to effect changes in their
immediate community which will improve the environment. </P>
<B><P><a name="background">Background</a></B>: </P>
<P>&#9;Growing up in an urban environment surrounded by concrete schoolyards and
brick housing developments can be a real barrier to understanding the natural world.
```

Students at the Seven Hills Charter School are living and going to school in such an environment. Seven Hills is located within Worcester city, less than a mile from its business and commercial center. Students are bussed to the school, arriving by 7:45 a.m. and stay until the end of the school day, arriving home between 3:30 and 4:30 in the afternoon. Many of the children stay in the school for an after school program until 6:00. There is no definable schoolyard, and recess time is spent indoors or on the school's concrete parking area. Not surprisingly, children in such communities perceive the "environment" as something that exists in the Colorado mountains or California deserts - places they only read about. </P>
<P>	Yet Worcester is rich in natural resources including water. There are three unique geographical watersheds located within the city limits, which comprise the headwaters of the Blackstone River. Historically, the Tatnuck watershed has been protected as drinking water supplies, although it has supported some industrial areas. The central watershed, comprised of Mill Brook and the Blackstone Canal, has been exploited for industrial use, including processing and waste removal, while Quinsigamond, the eastern most watershed, has historically been preserved for recreational purposes. During the industrial revolution, Worcester was transformed into a port city with the construction of the Blackstone Canal, linking Worcester to the Atlantic Ocean. In the late 19th century, Worcester became one of the major industrial cities in America. At the time the prevailing attitude was that toxic materials would disappear if dumped into a water body, buried in the ground, or dispersed into the air. As a result, the Blackstone Canal became a toxic soup of sewerage and industrial waste. Eventually, the canal became linked to tuberculosis and other public health epidemics and the canal itself, as well as many other polluted waterways, were actually covered over. </P>
<P>	In the twentieth century, Worcester lost most of its heavy industry, but the long term environmental effects of short-term economic success are still evident. The Clean Water Act, passed in the 1970s, began the process of improving water quality and the health of Worcester's waterways now is far better than it was two decades ago. However, public awareness, especially in urban environments, of the effects of local behavior on the entire watershed, requires ongoing education. Understanding that a polluted river which affects drinking water is a neighborhood problem as well as an environmental issue requires that communities be educated and empowered to be environmental stewards.</P>
<B><P>I. Needs and Methodologies</B>: </P>
<P>	Conservation groups, including the Environmental Protection Agency and the Audubon Society predict that changing behaviors in urban areas will have a direct impact on improving water conditions throughout the watershed. Using children as a catalyst for change, this program seeks to change behaviors through education and dissemination of information.</P>
<P>	Through discussion including partners, parents, teachers and students, the specific goals and objectives of the program were identified. Student input was instrumental in defining the type and content of the activities outlined in this proposal, including the frequent field trips, the hands on activities and the active use of reflections throughout the program. The theme, <I>WaterWorks</I>, was agreed to be an ideal focus because it holds no economic, racial, gender, cultural or housing barriers- it affects all of our lives. Additionally, this project, with its use of analytical and scientific inquiry

methods was identified as a wonderful adjunct to the school's basic science curriculum which culminates in every grade with a unit on the environment. </P>
<P>	Improving the participants understanding of water issues - where it comes from, where it goes, and why it is important to protect water supplies- will teach them to respect the natural resources that surround them and empower them to help others join in protecting their local and global environment. Dissemination of their outcomes through local involvement in the Department of Public Works storm drain stenciling program and Earth Day clean-up, as well as student lead community education seminars and web site development, will provide participants with concrete evidence of their service to the community.</P>
<B><P>II. Service Project</B>:</P>
<P>	<U>Participants</U>: The participants will include three partner organizations. </P>
<P>	Seven Hills Charter School: Thirty students from the school will be recruited as participants from among the upcoming sixth, seventh and eighth grades. Details of the recruitment plan and assurances of community representation will be detailed in Participant Development, Section III. The school, which serves as the applicant organization, will also provide administrative support for the project. One of the project directors will be recruited from the school's science faculty and will serve as the on-site coordinator for the program at the Seven Hills site. Classroom activities and technology components of the project will also take place at the school. </P>
<P>	Massachusetts Audubon Society: Field sessions, including watershed reconnaissance and sampling, as well as follow up educational sessions will be led by trained teacher naturalists from the Massachusetts Audubon based at the Broad Meadow Brook Education Center and Wildlife Sanctuary. Mass Audubon will provide transportation to the field sites and supervision by on-site staff at each location. They will be responsible for selection of field sites and recruitment of on-site presenters.</P>
<P>	Worcester Polytechnic Institute will participate through its Interactive Qualifying Project program. All students at WPI must complete a project which examines how science or technology interfaces with societal structures and values. Student teams are lead by faculty advisors, with projects normally extending over the course of an academic year. While project teams are not restricted to topics relating to their major disciplines, many draw on their majors in selecting a project. Students might study Principles of Ecology, Regulation of the Environment or Environmental Engineering in preparation for this project. The IQP team will be responsible for learning the basic tools for social science research, designing and administering questionnaires to the participants, conducting interviews and analyzing outcomes. They will also share responsibility with the project directors for activities both in the classroom and in the field on a weekly basis.</P>
<P>	<U>Program</U>: The program will operate for forty weeks during the school year, with participants meeting one afternoon a week from 3:30 until 5:00 and eight to ten Saturdays, from 9:00 a.m. to 3:00 p.m. The group will be divided into two teams, and generally one team will be at a field site and one team at the school during each after school session. All participants will be included in the Saturday sessions. </P>
<P>	Each school session will be divided to include reflections, training and service activities (see sample schedule). Students will spend time reflecting on the field

experience of the previous week, and proposing short, take-home messages or personal reactions to things they have seen or learned. These will be the basis for a <I>Waterworks</I> web site which will be designed and set up by the IQP team, and linked to the web sites for Seven Hills, WPI and the Audubon Society. Using the computer capabilities at Seven Hills, students will be responsible for weekly updates of the web site. They may choose to include photographs of field sites which can be imaged with a digital camera, drawings or diagrams included in their reflections which can be scanned into the site, or informational or reflective text. Service activities will focus on the preparation of community information sessions to be presented at Earth Day, at a community education day hosted at Seven Hills, at the Audubon Society's Broad Meadow Brook Education Center and Wildlife Sanctuary, and at WPI as part of the university's Project Presentation day. Students will work with the IQP team to design the presentations which may include posters for each site visited, presentations by student teams, displays of artwork or writing inspired by the project and/or demonstrations of the web site. Students may also make mini-presentations of their work in individual classrooms at the invitation of teachers. On one or more Saturdays, students will also work in teams under the direction of the Worcester Public Works Department to stencil neighborhood storm drains with notices in Spanish or English that read " Don't dump-Drains to (add name of body of water)". Students will also form teams to participate in cleaning up specific sites in the city as part of the community clean up effort associated with Earth Day. </P>
<P>	Training sessions will be lead by the Audubon and Seven Hills directors with help from the IQP team members. Teaching will focus on natural history and scientific analysis. Students will learn to make observations and collect samples in the field and will have opportunities for hands-on learning in the school sessions during which, for example, experiments in water quality testing, invertebrate sampling and bacterial plating would be introduced. Students will learn to make connections between actions and outcomes, e.g. sewage treatment and coliform counts. They will also gain skill in formulating questions and seeking information about remedial activities in which the community might participate as they interact with professionals at their various field sites. </P>
<P>	<U>Outcomes</U>: The specific aims and outcomes of the program include objectives for both program participants and the community served. The objectives for participants include:</P>
<P>1. Specifically introducing participants to the issues of water quality and water pollution</P>
<P>2. Giving participants an expanded concept of their role in and impact on the environment, both local and global</P>
<P>3. Empowering participants to affect change in their community through education and awareness programs</P>
<P>4. Providing tangible evidence of the program's role in the community through storm drain stenciling and Earth Day clean up.</P>
<P>5. Linking personal reflection and growth to global change through dissemination to other sites via the internet</P>
<P>6. Connecting past behaviors to current problems and current behaviors to future change. </P>

<P>The objectives for the community service component include:</P>
<P>1. Educating families about local issues regarding environmental and water quality within the Blackstone River watershed</P>
<P>2. Increasing awareness and understanding of the impact of local behavior on the broader community (watershed area) and its environment</P>
<P>3. Enhancing the visibility of youth community service in the city by modeling positive change initiated by "teenagers"</P>
<P>	<U>Sample schedule for participant in <I>Waterworks</I></U>: Since the group will be divided into two teams, a sample for each team is given, one in plain type, the second in Italics. For the second group, time is designated as reflection, training or service related.</P>
<P>3:30- 3:50	Assemble and board transportation and travel to Bell Pond, one of the original water supplies for the city.</P>
<P>		<I>Assemble and spend five to ten minutes writing short observations/ impressions from the previous week's field trip. Break into small groups to compare thoughts and reflections.(REFFLECTION TIME) Define the take home message for the week. Design a verbal and visual piece for the web site and for potential use in the education seminar (SERVICE TIME).</P>
</I><P>3:50-4:15	Collect water samples from various areas of the pond. Working with the teacher/naturalist, make and record observations of the area. Hypothesize what things have changes in the past that may have affected water quality. Make a draft map of the area.</P>
<P>	<I>Set up for analysis of water samples collected the previous week. Learn techniques for monitoring pH, dissolved oxygen. Sieve samples and observe collected specimens (TRAINING TIME).</P>
</I><P>4:15-4:35	Complete collection and observation. Compare results. Catalog samples and specimens and discuss proper storage for future analysis. Package samples for return to school.</P>
<P>		<I>Record data and observations. Discuss options for presentation of data and conclusions which can be drawn. What has your assessment taught you about the water? (REFLECTION and SERVICE TIME)</P>
</I><P>4:35-5:00	Return to school. Store samples away for future use. Discuss preparations for next week.</P>
<P>		<I>Complete data collection and recording. Clean up. Discuss what differences your data has from that which might have been collected at various times in history and why (REFLECTION TIME).</P>
</I><U><P>Saturday session examples:</U> </P>
<P>Storm drain stenciling				visit to Worcester's water filtration plant</P>
<P>Earth Day clean-up					Tatnuck watershed reconnaissance</P>
<P>Community Education Day at Seven Hills		</P>
<U><P>Accessibility to persons with disabilities</P>
</U><P>	Seven Hills Charter School welcomes all students, parents, employees or visitors, regardless of age, race, sexual orientation, religious affiliation , gender or handicap who wish to participate in the life of our school community. Our school accepts

and embraces all its members and the physical plant reflects this conviction in its handicapped-accessible design.</P>
<B><P>III. Participant Development: </P>
<P>	</B><U>Recruitment</U>: Because participants come from a defined group- the student body at the Seven Hills Charter School- recruitment will be done through the school network. The school is a free, public school, open to residents of the city of Worcester. There are 662 students in grades K-8, with 227 in grades 6-8, the audience for this program. The current school population includes 2% native Americans, 19% African Americans, and 22% Hispanic students. 17% of the students have IEPs on file and 45% qualify for the free or reduced lunch fee program. </P>
<P>	Every family in the school is provided with a home computer which is networked to the school via The Common, the Seven Hills computer network system. All families are given computer training and are expected to log on to the network to access information about school policy, events, and other information on a routine basis. Mailing lists for specific groups can be assembled by the school's technology office on an as needed basis. A program announcement will be e-mailed to every family with a child entering grades 6-8, the Junior Academy at Seven Hills. Applications can be filled out electronically and returned to the program director at Seven Hills. If there are more interested students than the program can accommodate, the applications will be divided into single gender groups and equal numbers will be selected from each group by lottery. This will assure that an equal number of female students will be exposed to the science and inquiry based approach provided by this program. The Junior Academy's science director has specifically requested that this be done, based on the National Science Foundation's recommendation that active approaches be adopted to insure the inclusion of female students in science and inquiry learning, particularly at the junior high school level where student interest in science often drops off. </P>
<P>	The two objectives for student participant development are in the areas of education and empowerment. Education in concrete measures such as water quality and less tangible concepts such as cause and effect will happen throughout the program. All educational goals will be met through active, hands-on, and inquiry based learning. Students have clearly indicated their preference for active roles in learning, and the program will be structured to accommodate those preferences. Even reflections will become active when they are prepared for inclusion in web site updates and community education materials. Under the guidance of the program directors and the IQP team members, students will continually integrate information into a total picture which they will prepare in an ongoing way for their final presentation. Construction of a web site with weekly updates and calendars will also provide a means to visualize the progress and integrate the activities over time. </P>
<P>	Empowerment is an important part of participant development. One of the objectives of the community education seminar is to give students ownership of the service component of the project. Students will be responsible for planning, format, preparation and presentation of their final seminar. They will be encouraged to think about their audience and predict what approaches they can best use to persuade that audience to care and to change. There is no better way to learn and really understand something than to teach it to someone else. Tying behaviors to outcomes and education to change are useful approaches to many social and community issues. Hopefully students

will leave the <I>Waterworks</I> program with a sense that they have accomplished something. That sense will be reinforced every time they see a storm drain stenciled with "Don't dump! This drains into the Blackstone River."</P>
<B><P>IV: Evaluation and Continuous Improvement</P>
</B><P>	Surveys of information and attitudes before the start of the program and monthly during its duration will be carried out by the IQP team. One of the IQP requirements is to learn to construct surveys and analyze data. Planning for the evaluation aspect of the project will begin as soon as the IQP team is recruited for the project. While some of their data collection may be by questionnaires, other measures will be less direct. Asking one group of students to design a crossword puzzle or Frequently Asked Question (FAQ) file for the web site, and the other to write the answer the following week might be one clever way to assess ownership of information. Because the development of the web site and the educational presentations will be ongoing, the IQP team members who will have direct oversight of these activities can use them to monitor both interest and attitudes of student participants. Monthly meetings of the supervisory team will be held at which presentations of outcome data will be discussed and programmatic changes made to deal with unmet objectives. The inclusion of college students in the project is designed to provide not only positive role models for student participants, but also avenues of communication that might not exist with adult participants who are perceived as teachers. Final evaluation of program objectives will include community reaction to the educational sessions, assessed by number of attendees and answers to specific questions which will be solicited by questionnaires and interviews of community participants . Counters will be put on the web site to see how often it is accessed. Reminders about the site will be sent out on The Common routinely. Final evaluation of the project, including statistical analysis of the outcome data, will be done by the IQP team and included as part of their required presentation of their project to the WPI community. </P>
<U><P>Organizational capacity</U>:</P>
<P>	The Edison Project, which serves as the management team for the Seven Hills Charter School, considers its schools to be community centers. Our philosophy is that community service activities give important opportunities for connecting the school to its community. One of the staff positions in the school is that of Community Resources Director. Because Seven Hills is a newly established school, we do not have a long track record of community service, but are anxious to make positive strides in that direction. The school administration sees this program as an essential part of educating children to be active members of their community, both within and outside the school. Partnering with Massachusetts Audubon, which has a long history of education and advocacy, will lend strength and experience to the project. Each year Mass Audubon's educators provide over 600 environmental education programs to diverse audiences. This project is well suited to their conservation mission and to their educational strengths. Likewise, WPI has had, since the 1970s, an ongoing commitment to teaching its graduates to understand, as professionals and citizens, how their work will affect the larger society of which they are part. Thus the IQP concept is based in community service and has included both environmental and educational divisions since its inception. </P>
<P>	Discussions among the participants has included specific attention to providing diversity in staffing. The Audubon director has already begun the process of identifying

specific professionals who will be included as on-site supervisors for field sites with an eye to exposing the children to both women and minorities working in the field. Parent volunteers will be recruited from Seven Hills and encouraged to join students on Saturday field trips to act as transportation and field supervisors. These parents will represent the diversity of participants in the program (see recruitment data) and will also serve as part of the audience for community education. </P>
<P>	Funds to sustain the program will be sought from local foundations and corporations. Potential sponsors will be invited to the final educational seminar to see the positive outcome of the program. Additionally, members of the Board of Directors, (see attachment) many of whom are connected to local foundations and corporations, will be solicited for ideas about and connections to potential funding sources.</P>
<B><P>Q: Paulette: I need answers to the questions about fiscal oversight, management, auditing (pg. 11)</P>
<P>VI. Community Assets and Partnerships:</P>
<P>	</B>The Seven Hills Charter School is one of a group of (#) schools throughout the country which is managed by the Edison Project. Edison provides networking among its schools for students, faculty and administrators and families. This networking can be done electronically among all sites. Edison is committed to facilitating communication at various levels within the organization as one part of building a sense of community. Seven Hills also provides a school environment with a security system to assure safety even during after school hours, as well as science laboratories for hands -on learning. and a computer classroom in which all participants can have access to the schools computer network and software.</P>
<P>	Mass Audubon is currently collaborating with the National Parks Service and the Blackstone River Valley National Heritage Corridor Commission in guiding the development and use of the 250,000 acres which comprise the Heritage Corridor including the Blackstone River and its tributaries. National Park rangers will likely be instrumental in guiding field trips within the corridor for this program. The Commission has already produced maps and guided tours of many of the waterways and historic sites which will be beneficial in investigating the natural history associated with the water resources in Worcester. </P>
<P>	WPI has a long history of engineering, science education and technology. It supports a number of interdisciplinary environmental programs, including the Biology and Biotechnology Environmental Science Program. Conservation ecology projects in this division include collaborations with both Mass Audubon and the Massachusetts Division of Fisheries and Wildlife. Faculty in the Social Science and Policy Studies Department also provide advising in development of appropriate assessment for social science research as part of the training for IQP work. </P></FONT></BODY>
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site</u></b></center></h1>
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Works for me! program.</h3></p><hr>
<p>WaterWorks is a Community Service based Learning Project.  It is
designed to educate children about water quality issues.  The
students will then spread that information to the rest of the
community through community service programs.</p>
<p>This project is designed to be a community Partnership between schools,
local environmental organizations, and community service organizations.
The initial program was sponsored and funded by the Massachusetts Service
Alliance.</P><hr>
<center><h3>More information:</h3><br>
<a href="./index2.html">The Web page of the model program</a><br>
<a href="./grant.html">The grant written for the initial program</a><br>
<a href="./survey.html">Please evaluate this program by clicking
here!</a><br>
<a href="./wq1.html">Information on water quality issues studied by
the students.</a><br>
<a href="./suggestions.html">Words of wisdom from the IQP Team on how to
set this program up</a>
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<h3><B>	A concerned student wrote this from the Seven Hills Charter School who is involved in the Water Works Project</h3>
<P> </P>
<P>Massachusetts DEP</P>
<P>627 Main Street</P>
<P>Worcester, MA</P>
<P>01608</P>
<P> </P>
<P>Dear Mr. Robert Golledge,</P>
<P>	I am an eighth grade student at the Seven Hills Charter School writing on behalf of the Participants of Water Works.</P>
<P>Water Works is an extracurricular program that includes twenty one sixth, seventh, and eighth grade students. We are studying the Blackstone Heritage Corridor and the Worcester waterways. Our program is funded through a Mass Service Alliance Grant which provides us with transportation, materials, and other necessary items to complete the program.</P>
<P>On an outing to Providence, Rhode Island we made a short detour into Fisherville, Massachusetts. We observed an old factory that had been standing there since 1917. The environment surrounding the factory is severely threatened because of a leaking oil canister located at the bottom of the factory. We were notified on how the oil is mixing with the ground water and flowing into nearby streams and rivers. Our tour guide mentioned how she visited the site prior to our visit and observed a family of turtles that were coated in an oily film.</P>
<P>It is obvious that someone has already taken action. A boom is in place to absorb oil on the surface of the water. The problem however, is that the boom needs to be disposed of properly and replaced. If not the oil will continue to drain into the Blackstone River.</P>
<P>I would appreciate your help in looking into this matter. Thank you for your time.</P><DIR>
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ALIGN="CENTER"></P>
</FONT><U><FONT FACE="Arial" SIZE=5 COLOR="#0000ff"><P>The Seven Hills
Charter School</P>
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</U></FONT><FONT FACE="Arial" COLOR="#0000ff"><P>(a special group of the 6th, 7th, & 8th graders)</P>
</FONT><FONT FACE="Arial" SIZE=4 COLOR="#0000ff">
<P>Vasti Aguilar</P>
<P>Patrice Beckford</P>
<P>Haydee Bezares</P>
<P>Rodrigo Esparza</P>
<P>Philip Ferland</P>
<P>Alfredo Fleites</P>
<P>Keonna Gavin</P>
<P>Kristen Kontaxi</P>
<P>Jessica Libby</P>
<P>Jessica Mitchell</P>
<P>Natacha Nieves</P>
<P>Daniel Poisson</P>
<P>Jennifer Reynoso</P>
<P>Tom Saliba</P>
<P>Sarah Sonier</P>
<P>Lindsay Stead</P>
<P>Sarah Thoman</P>
<P>Destinee Viveros</P>
<P>Brandon Warren</P>

<P><u>On Site Coordinator: </u> </P>
<P>Mara Gorden (</FONT><A HREF="mailto:mgorden@sevenhills.edisonproject.com">mgorden@sevenhills.edisonproject.com</A><FONT FACE="Arial" SIZE=4 COLOR="#0000ff">)</P>

<u>Massachusetts Audubon Society</u>
Deb Cary, Sanctuary Director
Gail Howe, Conservation Coordinator
Donna Williams, Conservation Advocacy Coordinator
Rob Gough, Education Coordinator
Kristin Daley, Natural History Instructor

</FONT><U><FONT FACE="Arial" SIZE=4 COLOR="#0000ff"><P>Worcester Polytechnic Institute IQP Group</P>
</U><P></u><FONT FACE="Arial" SIZE=4 COLOR="#0000ff">Kathryn Thorsen (<u><A HREF="mailto:katiet@wpi.edu">katiet@wpi.edu</A><FONT FACE="Arial" SIZE=4 COLOR="#0000ff">)</P>
<P></u><FONT FACE="Arial" SIZE=4 COLOR="#0000ff">Joseph Hausmann (<u><A HREF="mailto:joehouse@wpi.edu">joehouse@wpi.edu</A><FONT FACE="Arial"

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<P></u><FONT FACE="Arial" SIZE=4 COLOR="#0000ff">Blair
Altemus (</font><A
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<P><FONT FACE="Arial" SIZE=4 COLOR="#0000ff"><u>Advisor:</u></P>
<P></u>Jill Rulfs (</font><u><A
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<a href="./quiz.html"><P>The Water Works quiz</a> - the results of the
quiz taken by the 31 students who started the program.</P>
<p><a href="./letter.html">Direct Action</a> - the work of one student
trying to make a difference. </P>
<a href="./watershed.gif"><P>Where we are</a> - a map of the Blackstone
Valley National Heritage Corridor.</P>
<a href="./members.html"><p>Who we are</a> - a list of the partners in the
original Waterworks grant.</p>
<a href="./schedule.html">What we've done</a> - a list of trip's we've
been on, and where we will go in the future!<br>
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for people trying to set up a program similar to this </p> </DIR>
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<P>&#9;&#9;&#9;&#9;<B><U><FONT SIZE=5>The Water Quality Quiz</P>
</B></U></FONT><P>&#9;This quiz was give to the thirty-one students who started
the Water Works program to test their knowledge of water pollution, its causes and
effects, and the watershed in which they live. The results are listed next to the
responses.</P>
<P> </P>
<P>Circle the best response to each of the following questions or statements.</P>
<OL>

<LI>The animals which are the largest contributors to water pollution are:</LI></OL>

<OL TYPE="a">
<OL TYPE="a">

<LI>Fish 23%</LI>
<LI>Humans 65%</LI>
<LI>Canada geese 13%</LI>
<LI>Frogs 0%</LI></OL>
</OL>
<P> </P>
<ol>2. Worcester City water supplies come from:</ol>
<OL TYPE="a">
<OL TYPE="a">

<LI>Wells under the city 19% </LI>
<LI>Lake Quinsigamond 3%</LI>
<LI>The Quabbin reservoir 19%</LI>
<LI>Wachusett reservoir 55%</LI></OL>
</OL>

<P> </P>
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<OL START=3>

<LI>Polluted water is harmful to:</LI></OL>

<OL TYPE="a">
<OL TYPE="a">

<LI>Fish 19%</LI>
<LI>Water plants 0%</LI>
<LI>Infants 3%</LI>
<LI>All of the above 74%</LI></OL>
</OL>

<P> </P>
<OL START=4>

<LI>You can always tell if water is polluted by how it looks or smells:</LI></OL>

<OL TYPE="a">
<OL TYPE="a">

<LI>True 61%</LI>
<LI>False 35%</LI></OL>
</OL>

<P> </P>
<OL START=5>

<LI>Is there a level of acceptable contamination for drinking water?</LI></OL>

<OL TYPE="a">
<OL TYPE="a">

<LI>Yes, small amounts of contaminants are o.k. 26%</LI>
<LI>No, drinking water must be free of all types and levels of contamination
65%</LI></OL>
</OL>

<P> </P>
<OL START=6>

<LI>Water coming out of the faucet at Seven Hills:</LI></OL>

<OL TYPE="a">
<OL TYPE="a">
```

<LI>Comes directly from the city's water source 35%</LI>
<LI>Is just filtered by the faucet 13%</LI>
<LI>Is filtered and treated with chemicals to purify it 42%</LI>
<LI>Flows from underground caves 3%</LI></OL>
</OL>

<P> </P><DIR>

<P>7. Water that goes into the city storm drains:</P></DIR>

<OL TYPE="a">
<OL TYPE="a">

<LI>Empties into the sewer system 19%</LI>
<LI>Runs off into the ground 10%</LI>
<LI>Empties into ponds, lakes, or brooks throughout the city 45%</LI>
<LI>Goes directly into a water treatment plant 19%</LI></OL>
</OL>

<P> </P>
<OL START=8>

<LI>I think I know more than most adults about water pollution:</LI></OL>

<OL TYPE="a">
<OL TYPE="a">

<LI>True 16% </LI>
<LI>False 77%</LI></OL>
</OL>

<P> </P>
<OL START=9>

<LI>The showers in my house have "water saver" shower heads:</LI></OL>

<OL TYPE="a">
<OL TYPE="a">

<LI>True 10%</LI>
<LI>False 6%</LI>
<LI>I don't know 68%</LI>
<LI>There are no showers in my house 0%</LI></OL>
</OL>

<P> </P>

<OL START=10>

<LI>There are rules about the amount of water that public places (like schools) can use in flushing toilets:</LI></OL>

<OL TYPE="a">
<OL TYPE="a">

<LI>True 23%</LI>
<LI>False 65%</LI></OL>
</OL>

<P> </P>
<P>Respond to the following questions by circling the response that best describes your attitude or behavior.</P>
<OL TYPE="A">

<LI>I turn off the water when I brush my teeth:</LI></OL>

<OL>
<OL>

<LI>Always 35% </LI>
<LI>Most of the time 32%</LI>
<LI>Some of the time 13%</LI>
<LI>Never 10%</LI></OL>
</OL>

<P> </P>

B. I throw trash onto sidewalks or streets:</OL>

<OL>
<OL>

<LI>Always 6%</LI>
<LI>Most of the time 3%</LI>
<LI>Some of the time 48%</LI>
<LI>Never 35%</LI></OL>
</OL>

<P> </P>

C. My showers last under ten minutes:</OL>

<OL>

<OL>

<LI>Always 10%</LI>
<LI>Most of the time 39%</LI>
<LI>Some of the time 16%</LI>
<LI>Never 26%</LI></OL>
</OL>

<P> </P>

D. I think that rivers are important in keeping our city running:
</OL>

<OL>
<OL>

<LI>Totally agree 45%</LI>
<LI>Somewhat agree 48%</LI>
<LI>Somewhat disagree 0%</LI>
<LI>Totally disagree 0%</LI></OL>
</OL>

<P> </P>

E. I am certain of how city water is recycled in sewage treatment plants: </OL>

<OL>
<OL>

<LI>Totally understand 13%</LI>
<LI>Somewhat understand 26%</LI>
<LI>Somewhat unsure 32%</LI>
<LI>Totally unsure 23%</LI></OL>
</OL>

<P> </P>

F. I can do things that will affect the water quality of the ocean:</OL>

<OL>
<OL>

<LI>Definitely can 39%</LI>
<LI>Probably can 35%</LI>

```
<LI>Probably cannot 10%</LI>
<LI>Definitely cannot 6%</LI></OL>
</OL>
<a href="./other.html">BACK</a>
</BODY>
</HTML>
```

<schedule.html>

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1252">
<META NAME="Generator" CONTENT="Microsoft Word 97">
<META NAME="Template" CONTENT="C:\PROGRAM FILES\MICROSOFT
OFFICE\OFFICE\html.dot">
<title>Water Works Schedule of Events</title>
</HEAD>
<BODY text="#0000ff" LINK="#0000ff" VLINK="#800080">
<body background="Image1.jpg">
<B><U><FONT SIZE=5>
</B></U><P>&#9;&#9;&#9; <B><U>Water Works Schedule of Special Events</P>
</B></U></FONT><P>&#9;&#9;&#9;&#9;&#9;&#9;(subject to change)</P>
<P> </P>
<P> </P>
<B><FONT SIZE=4><P>September 26</B>&#9;</FONT>Heritage Corridor bus tour to
Providence</P>
<B><FONT SIZE=4><P>October 17&#9;&#9;</B></FONT>Waterways Cleanup;
Worcester</P>
<B><FONT SIZE=4><P><a href="./Bbrook.html">November
14</a>&#9;</B></FONT>Our Waterways; Worcester</P>
<B><FONT SIZE=4><P><a href="./12-5-98.html">December
5</a></B></FONT>&#9;Worcester Waterways; tour of the filtration plant</P>
<B><FONT SIZE=4><P>January 23</B></FONT>&#9;&#9;The Working River;
Explore the watershed</P>
<B><FONT SIZE=4><P>February 24</B></FONT>&#9;Seven Hills Presentation;
potluck dinner</P>
<B><FONT SIZE=4><P>February 27</B></FONT>&#9;Snow date / makeup day</P>
<B><FONT SIZE=4><P>April 24</B></FONT>&#9;&#9;Earth Day Festival; Green
Hill Park, Worcester</P>
<B><FONT SIZE=4><P>May 8</B></FONT>&#9;&#9;Audubon Society Celebration
at Broad Meadow Brook Sanctuary</P>
<B><FONT SIZE=4><P>May 22</B></FONT>&#9;&#9;Canoeing; Worcester</P>
<B><FONT SIZE=4><P>June 12</B></FONT>&#9;&#9;Storm Drain Stenciling</P>
<B><FONT SIZE=4><P>June 19</B></FONT>&#9;&#9;Rain Date for Storm Drain
Stenciling</P></BODY>
```

<hr>
BACK
</HTML>

<suggestions.html>

<HTML>
<HEAD>
<title>WaterWorks Tips and Suggestions</title>
</HEAD>
<BODY text="#0000ff" LINK="#0000ff" VLINK="#800080">
<body background="Image1.jpg">

<h2><u> How to set up a Water Works program in your school: </u></h2>

<p> This water conservation program is designed as a collaboration between a school, to provide the participants and a weekly meeting place, and a conservation group, such as the Audubon Society or other organization capable of providing education to the students. If possible try to include a local college to handle technical and assessment aspects of the program. Funding for the project, if needed, should be sought through your state's community service and education programs. As shown on the example page, it is advantageous to take frequent trips to local bodies of water so that the students realize that the problem is local, and that they are capable of changing it. To gauge how bad the water quality problem is, it may be useful to take water samples and do basic quality analysis. A page in the web-site has been included to help understand the data, consult a science text on how to do the tests. The students should quickly learn that direct action on the part of the individual and changes in water-use habits are the best means of making a difference. It may be advantageous to assess the effectiveness of the project through the use of a quiz, given at the beginning and again at the conclusion of the project. More data can be collected by the college students if applicable to your program. An example of such a quiz is provided on the sample web-page. If sufficient time and resources are allowed, it is suggested that the group build a web-page, with help from a college (if applicable), containing their collected data and any actions undertaken to help the watershed. One of the students wrote a letter to try to get an oil-contaminated site cleaned up, efforts like this should be rewarded and noted on the site.
<p> This program is designed for a group of 20-30 students, meeting once a week for an hour and a half so the affected group of people would normally be small. It is encouraged that the students set up a community education piece of some sort. The effort could be minimal and passive, like a pamphlet or flier. For a limited budget, signs above storm drains warning people what body of water they pollute by dumping there. A more

involved example would include a parent's night at the school, preferably a walk through exhibit, and/or an earth day booth at a local festival, rather than a lecture. These education pieces are just some suggestions and were tried by the group of students we worked with.
  When attempting to do such an education piece at your school, be sure to keep in touch with all of the groups involved, set up meetings to discuss progress and stay on track. It is important that the focus stay on keeping the students interested, so that the knowledge they acquire is not forgotten and that it is passed on.
 : Good communication is essential to making the program work. The original grant specified monthly meetings to discuss the progress of the program. It can not be overstated that this is a minimum and we feel meeting should be held as often as possible and conveinient for all parties involved.
  This project is ideally performed by 20-30 students spending one and a half hours a week after school either collecting data or being educated through in class activities like a mock town meeting discussing sewage treatment options and occasional weekend trips. It is ideal for students that have a community service requirement for graduation at their schools. Please take the time to inform yourself about how the whole thing works by reading the grant that directed our project and the page dedicated to the scientific data about water quality. If you would please fill out our survey/quiz we would be grateful.
<dir><dir>Thank you for your time.
</dir></dir>

<hr>
BACK

<survey.html>

<HTML>
<HEAD>
<TITLE>Help us Evaluate the Water Works Program!</TITLE>
</HEAD>
<BODY>
<body background="water1.gif" text=white link=red vlink=blue>

<hr> <img src="consbar.gif">
The Survey has been fixed, Its up and
running! Please help us out and evaluate this program and
the web page!
<hr>
<table border=3 cellspacing=2 width="90%">
<tr>

```
<td width="35%">
<center><b>WaterWorks Service Education Program</b>
<br><b>Survey</b></center>
</td><td width="20%">
<center><b><a href="./index.html">Home</a></b></center>
</td>
<td width="20%">
<center><b><a href="./wq1.html">water quality information</a></b>
</td>
</tr>
</table>
<p> Please take your Time, and look through the Page before answering this
survey!</p><dir>thanks!</dir>
</center>
<form method="post"
action="mailto:joehouse@wpi.edu?subject=waterworks survey"
enctype="text/plain">
<p>(optional) please enter your name:
<ul>First:<INPUT TYPE="text" Name="firstname" Size="10">
Last:<INPUT TYPE="text" Name="lastname" Size="15"></ul>
Your Return E-mail Address:<INPUT TYPE="text" Name="e-mail" size="40">
<br>
<p>Why did you visit our page?<br>
<textarea name="reference" rows="5" cols="60"
wrap="virtual"></textarea></ul>
<br>
<p>Do you live in the Blackstone River Watershed?<br>
<input type="radio" name="bstonevalley" value="yes">Yes<br>
<input type="radio" name="bstonevalley" value="no">No<br>
<hr width="125%">
<p>1) The water in the Worcester, Massachusetts area is:<br><br>
<input type="radio" name="ph" value="acidic">Acidic (pH < 7)<br>
<input type="radio" name="ph" value="basic">Basic (pH > 7)<br>
<input type="radio" name="ph" value="neutral">About Neutral (pH ~ 7)<br>
<input type="radio" name="ph" value="don't know">I Don't Know<br><br>
<p>2) The shower heads in my house are water saving shower heads:<br><br>
<input type="radio" name="water saving shower" value="yes">Yes<br>
<input type="radio" name="water saving shower" value="no">No<br>
<input type="radio" name="water saving shower" value="don't know">I Don't
Know<br>
<p>3) Bacteria in the water can cause (choose one):<br><br>
<input type="radio" name="bacteria causes" value="infection">Ear
Infections<br>
<input type="radio" name="bacteria causes" value="ulcer">Stomach
Ulcers<br>
<input type="radio" name="bacteria causes" value="flu">The Flu<br>
```

<input type="radio" name="bacteria causes" value="don't know">I Don't Know
<p>4) I can have a significant impact on the water quality of the ocean:

<input type="radio" name="ocean impact" value="yes">Yes
<input type="radio" name="ocean impact" value="no">No
<input type="radio" name="ocean impact" value="?">I Don't Know
<p>5) Which of the following are true:

<input type="radio" name="plant effects" value="turbidity hurts">High turbidity makes it difficult for plants to grow in water.
<input type="radio" name="plant effects" value="fertilizer helps">Fertilizer run-off can make plants in water grow too much.
<input type="radio" name="plant effects" value="both">Both of the Above
<input type="radio" name="plant effects" value="none">Neither of the Above
<input type="radio" name="plant effects" value="don't know">I Don't Know
<hr>
<p>6) Was this site well laid out and organized?

<input type="radio" name="organized" value="yes">Yes
<input type="radio" name="organized" value="no">No
<input type="radio" name="organized" value="lacks a little">Lacks a Little Organization
<input type="radio" name="organized" value="lacks a lot">Lacks Major Organization
<p>Please give us your comments on the organization of the page:
<textarea name="organizational comments" cols="60" rows="5" wrap="virtual"></textarea>

<p>7) If you were going to teach a unit on Water Quality and Conservation, would you consider using this page to help?

<input type="radio" name="would you use?" value="yes">Yes
<input type="radio" name="would you use?" value="no">No
<input type="radio" name="would you use?" value="needs more">If It Were More Informative
<input type="radio" name="would you use?" value="needs less">If It Were Less Informative

<p>What Other Information Should the Program Cover? What Should Be Removed?
<textarea name-"add or remove?" cols="60" rows="5" wrap="virtual"></textarea>

<p>8) How difficult was it to find the Answers to #1-#5 on this page?


```
<input type="radio" name="finding answers" value="very difficult">Very
Difficult<br>
<input type="radio" name="finding answers" value="somewhat
difficult">Somewhat Difficult<br>
<input type="radio" name="finding answers" value="somewhat easy">Somewhat
Easy<br>
<input type="radio" name="finding answers" value="very easy">Very
Easy<br>

<p>9) How would you respond to this statement?:<br>
<dir>"A student who has completed this program will be aware of how
his/her daily actions will affect the water quality in the watershed
around them."</dir><br>
<input type="radio" name="awareness" value="strongly agree">Strongly
Agree<br>
<input type="radio" name="awareness" value="agree">Agree<br>
<input type="radio" name="awareness" value="disagree">Disagree<br>
<input type="radio" name="awareness" value="strongly disagree">Strongly
Disagree<br>

<p>10) How would you rate this model site and program as a tool for
learning about and teaching water quality to others?<br><br>
<input type="radio" name="usefulness" value="poor">A Poor Tool<br>
<input type="radio" name="usefulness" value="lacking">Good Idea But
Lacking Some Minor Points<br>
<input type="radio" name="usefulness" value="satisfactory">A
Satisfactory Tool<br>
<input type="radio" name="usefulness" value="excellent">An Excellent
Tool<br>
<center>
<p>Please Add Any Comment About Any Aspect Of the Site!  Your Input Is
Very Helpful and Appreciated!<br>
<textarea name="comments" cols="60" rows="10" wrap="virtual"></textarea>
</center>
<CENTER><INPUT TYPE="Submit" Value="Submit"><INPUT TYPE="Reset"
VALUE="Clear"></CENTER>
<hr>
<center> Any futher questions or comments??  Please <a
href="mailto:joehouse@wpi.edu, katiet@wpi.edu, blair@wpi.edu">E-mail</a>
us!!
<br>
<a href="./">BACK</a><br>
<a href="/"><img src="wpi_banner.gif"></a><br>

</body>
</html>
```

<wq1.html>

```
</HEAD>
<BODY text="#0000ff">
<body background="Image1.jpg"><HTML>
<HEAD>
<a href="./WQ.html"><center><img src="water1.gif"><br>See what
water quality facts the kids have learned by clicking
here!</center></a>
<center><p><b><u><h3>or, click below to look at specific
topics</h1></u></b></p>
<a href="./WQ.html#DO">Dissolved Oxygen Concentration</a><br><br>
<a href="./WQ.html#BOD">BioChemical Oxygen Demand</a><br><br>
<a href="./WQ.html#coliform">Fecal Coliform Bacteria Count</a><br><br>
<a href="./WQ.html#pH">pH</a><br><br>
<a href="./WQ.html#Temp">Water Temperature</a><br><br>
<a href="./WQ.html#P">Total Phosphorus Concentration</a><br><br>
<a href="./WQ.html#N">Total Nitrate Concentration</a><br><br>
<a href="./WQ.html#turb">Turbidity</a><br><br>
<br><br><hr>
<a href="./">Back to the Main Page</a>
```

Appendix
C

Survey Replies

Responses

#1

firstname=John
lastname=Grossi
e-mail=jgrossi@bbnplanet.com
reference=because Joe told me to.
bstonevalley=no
ph=neutral
water saving shower=yes
bacteria causes=don't know
ocean impact=no
plant effects=fertilizer
helps
organized=yes
organizational comments=
would you use?=yes
finding answers=somewhat easy
awareness=agree
usefulness=satisfactory
comments=

#2

firstname=Maureen
lastname=Snare
e-mail=mxs337@psu.edu
reference=I was asked to visit the page to evaluate it.
bstonevalley=no
ph=don't know
water saving shower=yes
bacteria causes=infection
ocean impact=yes
plant effects=turbidity hurts
organized=yes
organizational comments=The fish are attractive links. I also like the
wallpapers chosen. The information provided was quite thorough.
would you use?=yes
finding answers=somewhat easy
awareness=strongly agree
usefulness=excellent
comments=

#3

firstname=H.
lastname=Engle
e-mail=engle@math.temple.edu
reference=
bstonevalley=no
ph=acidic
water saving shower=yes
bacteria causes=infection
ocean impact=?
plant effects=both
organized=lacks a little
organizational comments=I think the information might be more accessible if
divided
into separate pages for each topic. The list of information from the FieldGuide for Water Quality Monitoring seems just that... long. Also, the fish are
cute, but it might be nice to label them to make the page easier to navigate.
One last thing, I found the color combination of blue writing on the turquoise
water drop background to be a little aggravating on my eyes.
would you use?=yes
finding answers=somewhat
difficult
awareness=agree
usefulness=satisfactory
comments=

#4

firstname=Joe
lastname=
e-mail=jfisher@mail.mse.jhu.edu
reference=APO sent me
bstonevalley=no
ph=don't know
water saving shower=yes
bacteria causes=infection
ocean impact=yes
plant effects=both
organized=lacks a little
organizational comments=breaking down the what we've learned page into separate links would make it much easier to read. right now it just goes on and on...
would you use?=yes
finding answers=somewhat
difficult
awareness=agree
usefulness=lacking

comments=it's not all that easy to read on the background! Also, I don't know what age you're shooting for, but it seems that the presentation could be simplified some.

the fish are cool, but I'm not sure the pop-up flag is a good enough label. I wasn't sure at first how to navigate.

#5

firstname=Chelsea
lastname=Oller
e-mail=CheezyPoof123@yahoo.com
reference=Recieved the url from a friend
bstonevalley=no
ph=don't know
water saving shower=don't know
bacteria causes=ulcer
ocean impact=yes
plant effects=both
organized=yes
organizational comments=
would you use?=yes
finding answers=somewhat easy
awareness=agree
usefulness=satisfactory
comments=

#6

firstname=Jen
lastname=Headman
e-mail= headman@wpi.edu
reference=IQP's are important
bstonevalley=no
ph=acidic
water saving shower=yes
bacteria causes=infections
ocean impact=yes
plant effects=difficult
organized= yes
organizational comments=having a few different colors than blue would have made it a bit easier to read
would you use?=yes
finding answers=somewhat difficult
awareness=agree
usefulness=satisfactory

comments= IT was an interesting site, but some colors and maybe a definitive way of separating topics would be helpful. It was very difficult to find the information requested. The fish were cute

Appendix
D

The Web Page

Welcome to the waterworks site

Located on this site you will find information about the Water Works for me! program.

WaterWorks is a Community Service based Learning Project. It is designed to educate children about water quality issues. The students will then spread that information to the rest of the community through community service programs.

This project is designed to be a community Partnership between schools, local environmental organizations, and community service organizations. The initial program was sponsored and funded by the Massachusetts Service Alliance.

More information:

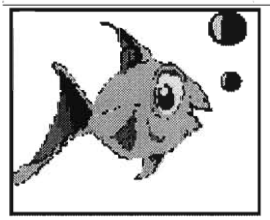
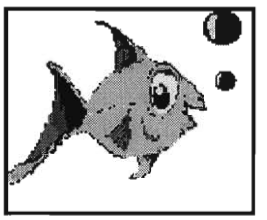
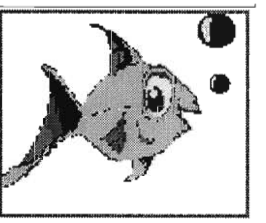
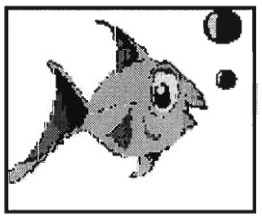
The Web page of the model program
The grant written for the initial program
Please evaluate this program by clicking here!
Information on water quality issues studied by the students.
Words of wisdom from the IQP Team on how to set this program up

---

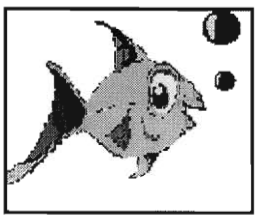
Welcome to the Water Works Homepage!

Upcoming Event!!!!

Waterworks Presentation February 24th from 6-8!

click on the fish to learn more!!!



Back to the Main Page

WPI

This Page has been visited 163 Times since 11/18/98

Other Tidbits of Water Works

The Water Works quiz - the results of the quiz taken by the 31 students who started the program.

Direct Action - the work of one student trying to make a difference.

Where we are - a map of the Blackstone Valley National Heritage Corridor.

Who we are - a list of the partners in the original Waterworks grant.

What we've done - a list of trip's we've been on, and where we will go in the future!

General Tips - a few words of adivce for people trying to set up a program similar to this

---

BACK

The Water Quality Quiz

This quiz was give to the thirty-one students who started the Water Works program to test their knowledge of water pollution, its causes and effects, and the watershed in which they live. The results are listed next to the responses.

Circle the best response to each of the following questions or statements.

1. The animals which are the largest contributors to water pollution are:

    a. Fish 23%
    b. Humans 65%
    c. Canada geese 13%
    d. Frogs 0%

2. Worcester City water supplies come from:

    a. Wells under the city 19%
    b. Lake Quinsigamond 3%
    c. The Quabbin reservoir 19%
    d. Wachusett reservoir 55%

3. Polluted water is harmful to:

    a. Fish 19%
    b. Water plants 0%
    c. Infants 3%
    d. All of the above 74%

4. You can always tell if water is polluted by how it looks or smells:

    a. True 61%
    b. False 35%

5. Is there a level of acceptable contamination for drinking water?

    a. Yes, small amounts of contaminants are o.k. 26%

b. No, drinking water must be free of all types and levels of contamination 65%

6. Water coming out of the faucet at Seven Hills:

   a. Comes directly from the city's water source 35%
   b. Is just filtered by the faucet 13%
   c. Is filtered and treated with chemicals to purify it 42%
   d. Flows from underground caves 3%

7. Water that goes into the city storm drains:

   a. Empties into the sewer system 19%
   b. Runs off into the ground 10%
   c. Empties into ponds, lakes, or brooks throughout the city 45%
   d. Goes directly into a water treatment plant 19%

8. I think I know more than most adults about water pollution:

   a. True 16%
   b. False 77%

9. The showers in my house have "water saver" shower heads:

   a. True 10%
   b. False 6%
   c. I don't know 68%
   d. There are no showers in my house 0%

10. There are rules about the amount of water that public places (like schools) can use in flushing toilets:

    a. True 23%
    b. False 65%

Respond to the following questions by circling the response that best describes your attitude or behavior.

A. I turn off the water when I brush my teeth:

1. Always 35%
2. Most of the time 32%
3. Some of the time 13%
4. Never 10%

B. I throw trash onto sidewalks or streets:

1. Always 6%
2. Most of the time 3%
3. Some of the time 48%
4. Never 35%

C. My showers last under ten minutes:

1. Always 10%
2. Most of the time 39%
3. Some of the time 16%
4. Never 26%

D. I think that rivers are important in keeping our city running:

1. Totally agree 45%
2. Somewhat agree 48%
3. Somewhat disagree 0%
4. Totally disagree 0%

E. I am certain of how city water is recycled in sewage treatment plants:

1. Totally understand 13%
2. Somewhat understand 26%
3. Somewhat unsure 32%
4. Totally unsure 23%

F. I can do things that will affect the water quality of the ocean:

1. Definitely can 39%

2. Probably can 35%
3. Probably cannot 10%
4. Definitely cannot 6%

BACK

A concerned student wrote this from the Seven Hills Charter School who is involved in the Water Works Project

Massachusetts DEP

627 Main Street

Worcester, MA

01608

Dear Mr. Robert Golledge,

I am an eighth grade student at the Seven Hills Charter School writing on behalf of the Participants of Water Works.

Water Works is an extracurricular program that includes twenty one sixth, seventh, and eighth grade students. We are studying the Blackstone Heritage Corridor and the Worcester waterways. Our program is funded through a Mass Service Alliance Grant which provides us with transportation, materials, and other necessary items to complete the program.

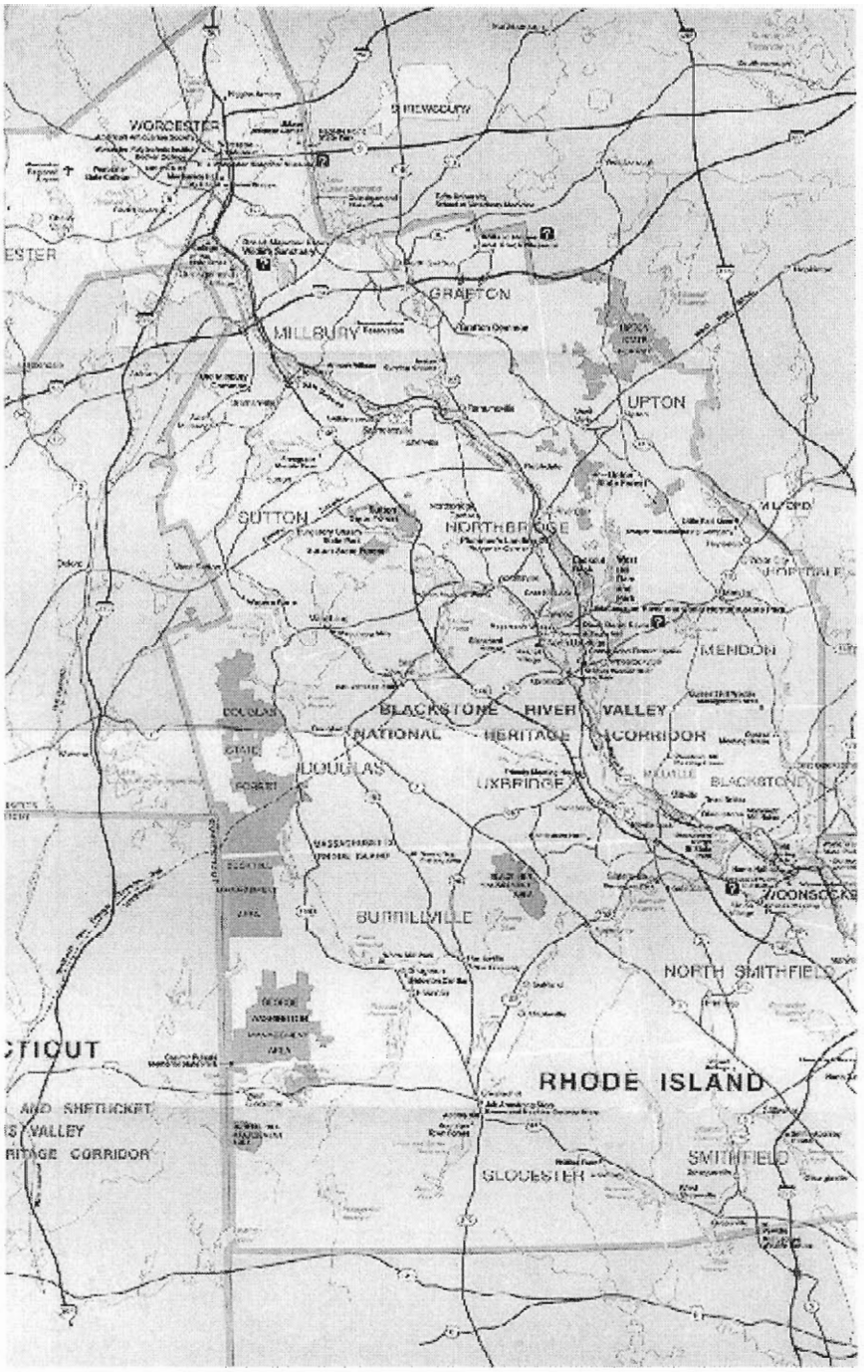
On an outing to Providence, Rhode Island we made a short detour into Fisherville, Massachusetts. We observed an old factory that had been standing there since 1917. The environment surrounding the factory is severely threatened because of a leaking oil canister located at the bottom of the factory. We were notified on how the oil is mixing with the ground water and flowing into nearby streams and rivers. Our tour guide mentioned how she visited the site prior to our visit and observed a family of turtles that were coated in an oily film.

It is obvious that someone has already taken action. A boom is in place to absorb oil on the surface of the water. The problem however, is that the boom needs to be disposed of properly and replaced. If not the oil will continue to drain into the Blackstone River.

I would appreciate your help in looking into this matter. Thank you for your time.

Sincerely,

BACK


WORCESTER
GRAFTON
MILLBURY
UPTON
SUTTON
NORTHBRIDGE
MENDON
BLACKSTONE RIVER VALLEY
NATIONAL HERITAGE CORRIDOR
DOUGLAS
UXBRIDGE
BLACKSTONE
WOONSOCKET
BURRILLVILLE
NORTH SMITHFIELD
RHODE ISLAND
SMITHFIELD
GLOCESTER

Those Involved

The Seven Hills Charter School

(a special group of the 6th, 7th, & 8th graders)

Vasti Aguilar

Patrice Beckford

Haydee Bezares

Rodrigo Esparza

Philip Ferland

Alfredo Fleites

Keonna Gavin

Kristen Kontaxi

Jessica Libby

Jessica Mitchell

Natacha Nieves

Daniel Poisson

Jennifer Reynoso

Tom Saliba

Sarah Sonier

Lindsay Stead

Sarah Thoman

Destinee Viveros

Brandon Warren

On Site Coordinator:

Mara Gorden (mgorden@sevenhills.edisonproject.com)

Massachusetts Audubon Society

Deb Cary, Sanctuary Director

Gail Howe, Conservation Coordinator

Donna Williams, Conservation Advocacy Coordinator

Rob Gough, Education Coordinator

Kristin Daley, Natural History Instructor

Worcester Polytechnic Institute IQP Group

Kathryn Thorsen (katiet@wpi.edu)

Joseph Hausmann (joehouse@wpi.edu)

Blair Altemus (blair@wpi.edu)

Advisor:

Jill Rulfs (jrulfs@wpi.edu)

BACK

Water Works Schedule of Special Events

(subject to change)

September 26 Heritage Corridor bus tour to Providence

October 17 Waterways Cleanup; Worcester

November 14 Our Waterways; Worcester

December 5 Worcester Waterways; tour of the filtration plant

January 23 The Working River; Explore the watershed

February 24 Seven Hills Presentation; potluck dinner

February 27 Snow date / makeup day

April 24 Earth Day Festival; Green Hill Park, Worcester

May 8 Audubon Society Celebration at Broad Meadow Brook Sanctuary

May 22 Canoeing; Worcester

June 12 Storm Drain Stenciling

June 19 Rain Date for Storm Drain Stenciling

BACK

Beaver Brook

Weather Conditions (Worcester)

Temperature: 48° F

Partly Cloudy

Date: 11/14/98

Time: 11:00 to 11:30 a.m.

For more information about what this data means, look HERE.

pH facts- the pH determines for how long and how many creatures or plants can live in that area at that time. The pH test that we have done is very similar to the tests you do with your pool.

pH results for Beaver Brook: 6.25

Dissolved Oxygen or D.O. results for Beaver Brook: 11 milligrams per liter of water.

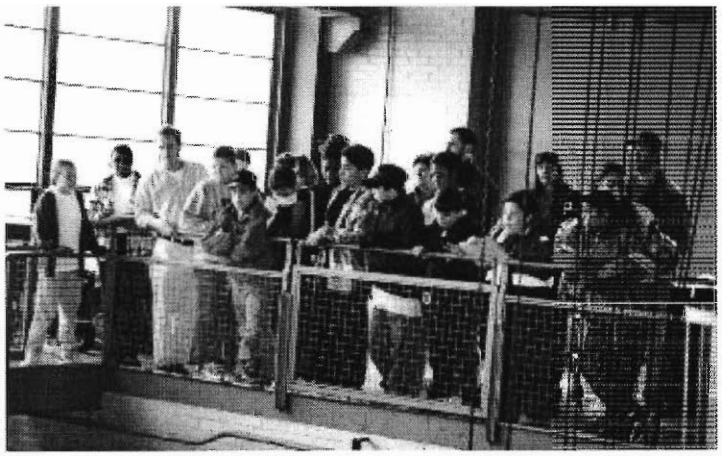
Nitrate facts- Nitrate can come from fertilizers, dog/animal droppings, or leaking septic systems. When these things reach water it causes the plants in that area to grow *too* much and decompose which takes a lot of oxygen.

Nitrate results for Beaver Brook: 0 Nitrate, which is very good.

Temperature of Beaver Brook: 44° F or 6.6° C

BACK

Here are some pictures of our trip!

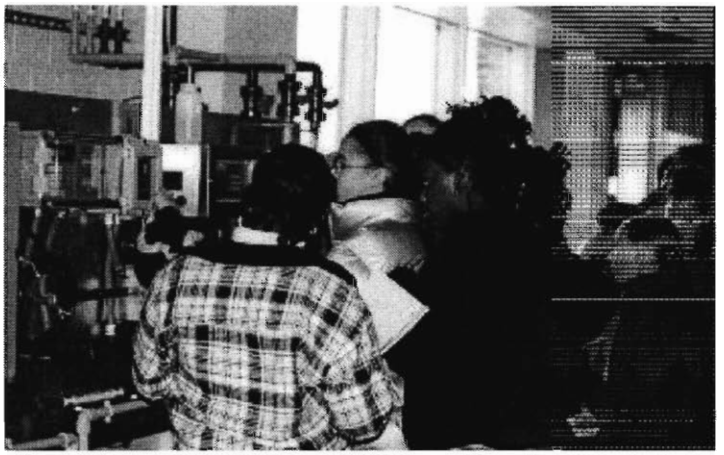


Lake Street Pump Station

This station pumps sewer material up over Belmont Hill to join flow to the main wastewater plant. This station has a generator that will allow the pumps to continue running for 3 weeks in the event there is a power failure.

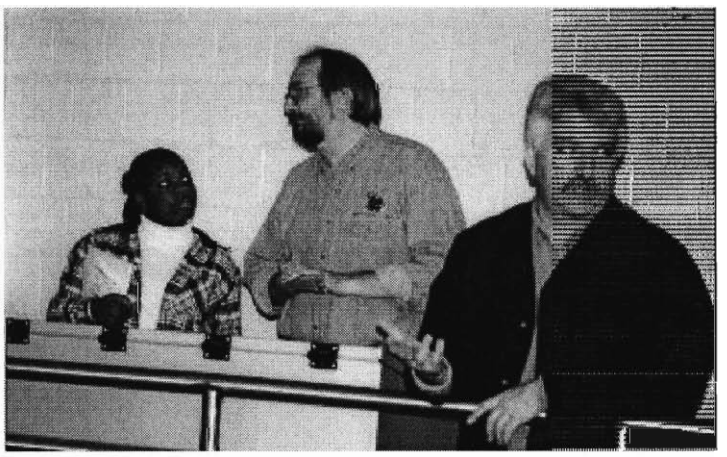
Lyndebrook Reservoir

This body of water is near the Leicester town line. This was the first reservoir the city built to replace Bell pond as the city's source of drinking water in the 1800's. Fill from the airport leached into the reservoir, making it unsafe to drink for two months until the filtration plant came on-line.



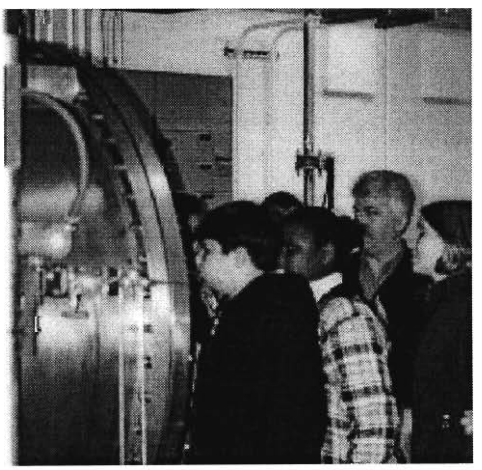
Water Filtration Plant

Here we see the pH monitors for the water before and after different steps in the Filtration process. The steps monitored are ozone treatment and the alum/flocculation treatment.



Water Filtration Plant

Keona Gavin talks to the Filtration Plant tour guide.



Ozone Disinfection

Tom Saleba ,Keona Gavin, and Lindsey Stead look into one of the Ozone Generators that are responsible for disinfection of the water.

BACK

Click on the Links to learn more about the different topics!!!!

Importance of Water Quality -Click here to learn what problems are caused by different types of pollution!

BACK

Assessing Water Quality

The Water Works participants collected water quality data at the sites that they visited. Few people know the meaning of the data that was collected. This page is designed to educate the visitor as to the meaning of the data the participants collected.

Dissolved Oxygen – DO Class B waters (fishable, swimmable) – shall be no less than 6mg/L (ppm) in cold water fisheries nor less than 5mg/L in warm water fisheries

Oxygen levels needed by fish:

DO level Result

2.0mg/L Fish can live for short periods

<3.0mg/L Few fish can survive for long

<5.0mg/L Fish grow and develop slowly

6.0mg/L Healthy level for most fish

Sources of dissolved oxygen:

- The atmosphere. Waves on lakes and slow moving rivers and tumbling water on fast moving rivers act to mix atmospheric oxygen with water.

- Photosynthesis of algae and rooted aquatic plants.

- DO levels rise from morning through the afternoon as a result of photosynthesis, reaching a peak in late afternoon. Photosynthesis stops at night, but plants and animals continue to respire and consume oxygen through the night. As a result, DO levels fall to a low point just before dawn.

Changes in DO:

- Build-up of organic wastes: anything that was once part of a living plant or animal, i.e. food, leaves, feces, etc.

- Natural sources of organic material.

- Organic matter entering lakes and rivers from swamps, bogs, and vegetation along the water, particularly leaf fall.

- Human sources of organic material.

- Point sources: identifiable points of discharge into rivers and lakes.

- Pulp and paper mills, meat packing plants, food processing industries, wastewater treatment pants.

- Non-point sources: polluted runoff, many sources, difficult to identify.

- Urban runoff of rain and melting snow that carries sewage from illegal sanitary sewer connections into storm drains and then to the nearest waterway; pet wastes from streets and sidewalks; nutrients from lawn fertilizers; leaves, grass clippings, and paper from residential areas.

- Agricultural runoff that carries nutrients, like nitrogen and phosphates from fields.

- Runoff from animal feedlots that carries fecal material into rivers.

- Aerobic bacteria decompose organic wastes and dead aquatic plants, consuming oxygen in the process. This leaves less oxygen for other aquatic species such as invertebrates and fish.

- Depletion of DO causes major shifts in kinds of aquatic organisms found in water bodies.

- High DO: mayfly nymphs, stonefly nymphs, caddyfish larvae, beetle larve, high diversity of organisms.

- Low DO: worms, fly larvae, a low diversity of pollution tolerant organisms

Amount of DO is a function of temperature:

- Oxygen dissolves more easily in cold water. The colder the water the more dissolved oxygen, the greater the percent saturation of DO. DO saturation greater than 90% indicates a healthy river.

Biochemical Oxygen Demand – BOD 5-day

BOD is the measure of the quantity of oxygen used by aerobic bacteria in decomposition of organic matter

- Aquatic plants. When aquatic plants die, they are fed upon by aerobic bacteria. The input of nutrients into a river, such as nitrates and phosphates, stimulates plant growth. Eventually, more plant growth leads to more plant decay, which uses up more dissolved oxygen, increasing the biochemical oxygen demand (BOD). Nutrients, then can be a prime contributor to high BOD in rivers.

- Organic Wastes. Impounded river reaches (large flat areas) also collect organic wastes

from upriver that settle in quieter water. The bacteria that feed on this organic waste consume oxygen.

BOD is determined by subtracting the 5-day DO test result from the testing day DO result. BOD is the difference between the two: it is the amount of oxygen consumed during the 5 days by organic matter and associated microorganisms in the water sample.

- Significance of BOD:

1-2 ppm (parts per million) Very clean water, little organic matter

3-5 ppm Moderately clean water, some organics

6-9 ppm Considerable organic decay

10+ ppm Very unhealthy, sewage possible

Fecal Coliform – FC Class B waters – no more than 200colonies/100mL

Coliform standards:

(colonies/100mL)

Drinking water 1TC

Total body contact (swimming) 200FC

Partial body contact (boating) 1000FC

Treated sewage effluent no more than 200FC

- Total coliform (TC). Includes bacteria from cold blooded animals and various soil organisms. According to recent literature, total coliform counts are normally about ten times higher than fecal coliform (FC) counts.

Fecal coliform bacteria are found in feces of humans and other warm blooded animals. FC bacteria can enter a river through:

- Direct discharge from mammals and birds.

- Agricultural and storm runoff carrying wastes from birds and mammals (cows, dogs).

- Human sewage discharged into water.

- Separate sewer system

- Sanitary wastes (from toilets, washers, and sinks) flow through sewer system of underground pipes to waste water treatment plant.

- Storm sewers carry rain and snowmelt from streets, and discharge untreated water directly into rivers.

- Heavy rains, melting snow wash bird and pet wastes from sidewalks and streets into catch basins then to waterways.

- Combined sewer system

- Sanitary wastes and storm runoff are combined in sewer system and treated at wastewater treatment plant.

- After a heavy rain, untreated or inadequately treated waste may be diverted into the river to avoid flooding the wastewater treatment plant.

FC by themselves are not disease-causing (pathogenic). Pathogenic organisms include bacteria, viruses, and parasites that cause diseases and illnesses. FC bacteria naturally occur in the human digestive tract, and aid in the digestion of food. In infected individuals, pathogenic organisms are found along with fecal coliform bacteria.

If FC counts are >200 colonies/100mL of water sampled in river, there is a greater chance that pathogenic organisms are also present. A person swimming in such waters has a greater chance of getting sick from swallowing disease causing organisms, or from pathogens entering the body through cuts in the skin, the nose, mouth, or the ears.

- Typhoid fever, hepatitis, gastroenteritis, dysentery, ear infections can all be contracted in waters with high fecal coliform counts.

pH Class B waters – in the ranges of 6.5-8.3 standard units

Water (H_2O) contains both H+ (hydrogen) ions and OH- (hydroxyl) ions. The pH test measures the H+ ion concentration of liquids and substances. pH values are on a scale from 0-14. More H+ than OH- ions, liquid is acidic and has a pH less than 7. More OH- than H+ ions, liquid is basic with pH more than 7.

pH most acid

0

1 Battery Acid

2 Lemon Juice

3 Vinegar

4 Cola

5

6 Normal Rain

7 Distilled Water neutral

8 Baking Soda

9

10

11 Ammonia

12 Bleach

13

14 most basic

Human-caused changes in pH

- Automobile and coal fired power plant emissions

- Nitrogen oxides (NO_x) and sulfur dioxide (SO_2) in emissions converted to nitric acid and sulfuric acid in atmosphere.

- Acids combine with moisture in atmosphere and fall to earth as acid rain or acid snow

- Causes lakes to become acidic

- Type of rocks and minerals determine acidity of local water

- Limestone neutralizes effects acids might have on lakes and streams

- Areas hardest hit by acid rain and snow are down wind of urban/industrial areas and do not have any limestone to reduce the acidity of the water.

Changes in aquatic life:

- Changes in pH value of water important to many organisms

- Most organisms have adapted to life in water of a specific pH and may die if it changes

even slightly, e.g. brook trout in some streams in the Northeast.

Life form pH range

Bacteria 2-13

Plants (algae, rooted, etc.) 6.6-12.3

Carp, suckers, catfish, some insects 5.9-9.5

Bass, bluegill, crappie 6.3-9.3

Snails, clams, mussels 7.5-9.8

Largest variety of animals (trout, nymphs, larvae) 7.0-8.5

Temperature Class B waters – shall not exceed 68 degrees F (20 degrees C) in cold water fisheries nor 83 degrees F (28.3 degrees C) in warm water fisheries.

The water temperature of a river is very important for water quality. Many of the physical, biological and chemical characteristics of a river are directly affected by temperature. For example, temp. influences:

- The amount of oxygen that can be dissolved in water.

- The rate of photosynthesis by algae and larger aquatic plants.

- The metabolic rates of aquatic organisms.

- The sensitivity of organisms to toxic wastes, parasites, and diseases.

Remember, cool water can hold more oxygen than warm water, because gasses are more easily dissolved in cool water.

Human-Caused changes in temperature:

* Thermal pollution: an increase in water temperature caused by adding relatively warm water to a body of water.

-Industries discharging water used to cool machinery

-Storm water running off warmed urban surfaces, such as streets, etc.

-Cutting down trees that help shade river

-Soil erosion: Raises water temperature because it increases the amount of suspended solids carried by the river, making the water cloudy. Cloudy water absorbs the sun's rays, causing water temperature to rise.

Changes in aquatic life:

-Increasing water temperature

-Rate of photosynthesis and plant growth increases

-More plants grow and die, are decomposed by bacteria that consume oxygen,

BOD increased

-Metabolic rate of organisms increases, greater BOD

-Decreasing dissolved oxygen

-Cool water species replaced by warm water species

-Affects aquatic life's sensitivity to toxic wastes, parasites, and diseases.

Temperature tolerance levels of selected aquatic organisms:

- >20° C/68° F

-Much plant life, many fish diseases, bass, crappie, bluegill, carp, and catfish

- 13-20° C/55-68° F

-Some plant life, some fish diseases, salmon, trout, stonefly nymphs

-Mayfly nymphs, caddisfly larvae, water beetles, and water striders

- <13° /55° F

-Trout, caddisfly larvae, stonefly nymphs, and mayfly nymphs

TOTAL PHOSPHOROUS – P concentrations of non-polluted waters are usually less than 1.66 mg/l (ppm) (Total phosphate (PO_4-P) should be less than 0.1 mg/l)

Phosphorous is an essential element for life, occurs naturally.

-Plant nutrient needed for growth: plant growth limited by amount of phosphorous available. Is "growth-limiting" because usually present in very low concentrations.

-Excess phosphorous causes extensive algal growth, called "blooms".

-Eutrophication

-Natural: lakes age slowly

-Natural sources of phosphorous in waterways

-Forest fires, fallout from volcanic eruptions

-Cultural: human caused, lakes age rapidly

-Human sources of phosphorous in waterways

-Sewage from wastewater treatment plants; illegal sewer connections, and septic systems

-Animal wastes from feedlot and barnyard runoff

-Industrial wastes

-Fertilizers used for crops, lawns and home gardens runoff

-Impacts:

-Increased phosphorous causes increased plant growth. Entire lake or river stretch may fill with aquatic vegetation.

-Algal bloom: pea-soup green water

-Advanced stages can produce anaerobic conditions in which oxygen in water is completely depleted – "rotten egg" smell

Changes in aquatic life:

-Shift in aquatic life to a fewer number of pollution-tolerant, low-DO-tolerant species such as carp, midge larvae, sewage worms.

-Waters that once supported bass, walleye, pike and bluegill may only be able to support carp under eutrophic conditions

Reversing the effects of Cultural Eutrophication:

Aquatic ecosystems have the capacity to recover if the opportunity is provided by:

- Reducing our use of lawn fertilizers (particularly inorganic forms) that drain into waterways;
- Encouraging better farming practices: low-till farming to reduce soil erosion; soil-testing to match the amount of fertilizer applied to soil need, thus preventing excess fertilizer from finding its way into waterways; building storage or collecting areas around cattle feedlots, so that phosphorus-containing manure is not carried away with surface runoff;
- Preserving natural vegetation whenever possible, particularly near shorelines; preserving wetlands to absorb nutrients and maintain water levels; enacting strict ordinances to

prevent soil erosion;
- Supporting measures (including taxes) to improve phosphorus removal by wastewater treatment plants and septic systems; treating storm sewer wastes if necessary; encouraging homeowners along lakes and streams to invest in community sewer systems; and
- Requiring particular industries to pretreat their wastes before sending it to a wastewater treatment plant.

NITRATES - NO_3 – unpolluted water should have less than 1 mg/l (ppm)

Nitrogen, in the form of ammonia and nitrates, acts as a plant nutrient and causes eutrophication like phosphorous does. However, unlike phosphorous, nitrogen rarely limits plant growth, so plants are not as sensitive to increases in ammonia and nitrates.

Human-caused changes in nitrates:

-Sewage is main source of nitrates added by humans to rivers.

-Inadequately treated wastewater from sewage treatment plants

-Illegal sanitary sewer connections

-Poorly functioning septic systems (usually single-family homes)

-May be placed too close to the water table so nutrients and bacteria are able to percolate down to the groundwater then to lakes or rivers.

-Must be emptied periodically. If not, system will overflow and sewage may start to pool on ground and enter water through surface runoff.

-Fertilizer runoff

-Animal waste runoff from feedlots and barnyards

Turbidity – T

Turbidity is a measure of relative clarity of water: the greater the turbidity, the murkier the water. T increases as a result of suspended solids in water that reduce the transmission of light and absorb heat from sunlight, causing water to become warmer and lose dissolved oxygen.

-Suspended solids:

-Can be clay, slit, plankton, industrial wastes, sewage, etc.

Human caused changes in turbidity:

-Soil erosion

-Waste discharge

-Urban runoff

-Abundant bottom feeders (such as carp) that stir up bottom sediment

-Algal growth

Changes in aquatic life:

-Decrease in species because of warmer water, less light, oxygen depletion

-Suspended solids can:

-Clog fish gills

-Reduce growth rate

-Decrease resistance to disease

-Prevent egg and larval development

This information is taken from ***FIELD MANUAL FOR WATER QUALITY MONITORING: An Environmental Education Program for Schools*** by Mark K. Mitchell and William B. Stapp.

BACK

Here are the different Pieces of the Grant

Abstract,Background,Methodology,Service,Development,Evaluation,Organization,Commu Assets

Abstract:

WaterWorks is a collaborative effort of the Seven Hills Charter School, an independent public school in Worcester; the Massachusetts Audubon Society, the largest conservation organization in New England; and Worcester Polytechnic Institute, the nation's third oldest private college of engineering and science. It is a community based, community service program, targeting the urban community associated with the charter school. Through field and classroom learning, tangible service activities and community education, the project will increase community awareness of local issues of water quality and conservation. Participation will establish current and historical links between local behaviors and larger environmental outcomes. Stenciling of storm drains and involvement in Earth Day clean-up will provide concrete evidence of student impact on the community. Student lead community education seminars and development of a *Waterworks* web site will empower the participants to effect changes in their immediate community which will improve the environment.

Background:

Growing up in an urban environment surrounded by concrete schoolyards and brick housing developments can be a real barrier to understanding the natural world. Students at the Seven Hills Charter School are living and going to school in such an environment. Seven Hills is located within Worcester city, less than a mile from its business and commercial center. Students are bussed to the school, arriving by 7:45 a.m. and stay until the end of the school day, arriving home between 3:30 and 4:30 in the afternoon. Many of the children stay in the school for an after school program until 6:00. There is no definable schoolyard, and recess time is spent indoors or on the school's concrete parking area. Not surprisingly, children in such communities perceive the "environment" as something that exists in the Colorado mountains or California deserts - places they only read about.

Yet Worcester is rich in natural resources including water. There are three unique geographical watersheds located within the city limits, which comprise the headwaters of the Blackstone River. Historically, the Tatnuck watershed has been protected as drinking water supplies, although it has supported some industrial areas. The central watershed, comprised of Mill Brook and the Blackstone Canal, has been exploited for industrial use, including processing and waste removal, while Quinsigamond, the eastern most watershed, has historically been preserved for recreational purposes. During the industrial revolution,

Worcester was transformed into a port city with the construction of the Blackstone Canal, linking Worcester to the Atlantic Ocean. In the late 19th century, Worcester became one of the major industrial cities in America. At the time the prevailing attitude was that toxic materials would disappear if dumped into a water body, buried in the ground, or dispersed into the air. As a result, the Blackstone Canal became a toxic soup of sewerage and industrial waste. Eventually, the canal became linked to tuberculosis and other public health epidemics and the canal itself, as well as many other polluted waterways, were actually covered over.

In the twentieth century, Worcester lost most of its heavy industry, but the long term environmental effects of short-term economic success are still evident. The Clean Water Act, passed in the 1970s, began the process of improving water quality and the health of Worcester's waterways now is far better than it was two decades ago. However, public awareness, especially in urban environments, of the effects of local behavior on the entire watershed, requires ongoing education. Understanding that a polluted river which affects drinking water is a neighborhood problem as well as an environmental issue requires that communities be educated and empowered to be environmental stewards.

I. Needs and Methodologies:

Conservation groups, including the Environmental Protection Agency and the Audubon Society predict that changing behaviors in urban areas will have a direct impact on improving water conditions throughout the watershed. Using children as a catalyst for change, this program seeks to change behaviors through education and dissemination of information.

Through discussion including partners, parents, teachers and students, the specific goals and objectives of the program were identified. Student input was instrumental in defining the type and content of the activities outlined in this proposal, including the frequent field trips, the hands on activities and the active use of reflections throughout the program. The theme, *WaterWorks*, was agreed to be an ideal focus because it holds no economic, racial, gender, cultural or housing barriers- it affects all of our lives. Additionally, this project, with its use of analytical and scientific inquiry methods was identified as a wonderful adjunct to the school's basic science curriculum which culminates in every grade with a unit on the environment.

Improving the participants understanding of water issues - where it comes from, where it goes, and why it is important to protect water supplies- will teach them to respect the natural resources that surround them and empower them to help others join in protecting their local and global environment. Dissemination of their outcomes through local involvement in the Department of Public Works storm drain stenciling program and Earth Day clean-up, as well as student lead

community education seminars and web site development, will provide participants with concrete evidence of their service to the community.

II. Service Project:

Participants: The participants will include three partner organizations.

Seven Hills Charter School: Thirty students from the school will be recruited as participants from among the upcoming sixth, seventh and eighth grades. Details of the recruitment plan and assurances of community representation will be detailed in Participant Development, Section III. The school, which serves as the applicant organization, will also provide administrative support for the project. One of the project directors will be recruited from the school's science faculty and will serve as the on-site coordinator for the program at the Seven Hills site. Classroom activities and technology components of the project will also take place at the school.

Massachusetts Audubon Society: Field sessions, including watershed reconnaissance and sampling, as well as follow up educational sessions will be led by trained teacher naturalists from the Massachusetts Audubon based at the Broad Meadow Brook Education Center and Wildlife Sanctuary. Mass Audubon will provide transportation to the field sites and supervision by on-site staff at each location. They will be responsible for selection of field sites and recruitment of on-site presenters.

Worcester Polytechnic Institute will participate through its Interactive Qualifying Project program. All students at WPI must complete a project which examines how science or technology interfaces with societal structures and values. Student teams are lead by faculty advisors, with projects normally extending over the course of an academic year. While project teams are not restricted to topics relating to their major disciplines, many draw on their majors in selecting a project. Students might study Principles of Ecology, Regulation of the Environment or Environmental Engineering in preparation for this project. The IQP team will be responsible for learning the basic tools for social science research, designing and administering questionnaires to the participants, conducting interviews and analyzing outcomes. They will also share responsibility with the project directors for activities both in the classroom and in the field on a weekly basis.

Program: The program will operate for forty weeks during the school year, with participants meeting one afternoon a week from 3:30 until 5:00 and eight to ten Saturdays, from 9:00 a.m. to 3:00 p.m. The group will be divided into two teams, and generally one team will be at a field site and one team at the school during each after school session. All participants will be included in the Saturday sessions.

Each school session will be divided to include reflections, training and service activities (see sample schedule). Students will spend time reflecting on the field experience of the previous week, and proposing short, take-home messages or personal reactions to things they have seen or learned. These will be the basis for a *Waterworks* web site which will be designed and set up by the IQP team, and linked to the web sites for Seven Hills, WPI and the Audubon Society. Using the computer capabilities at Seven Hills, students will be responsible for weekly updates of the web site. They may choose to include photographs of field sites which can be imaged with a digital camera, drawings or diagrams included in their reflections which can be scanned into the site, or informational or reflective text. Service activities will focus on the preparation of community information sessions to be presented at Earth Day, at a community education day hosted at Seven Hills, at the Audubon Society's Broad Meadow Brook Education Center and Wildlife Sanctuary, and at WPI as part of the university's Project Presentation day. Students will work with the IQP team to design the presentations which may include posters for each site visited, presentations by student teams, displays of artwork or writing inspired by the project and/or demonstrations of the web site. Students may also make mini-presentations of their work in individual classrooms at the invitation of teachers. On one or more Saturdays, students will also work in teams under the direction of the Worcester Public Works Department to stencil neighborhood storm drains with notices in Spanish or English that read " Don't dump- Drains to (add name of body of water)". Students will also form teams to participate in cleaning up specific sites in the city as part of the community clean up effort associated with Earth Day.

Training sessions will be lead by the Audubon and Seven Hills directors with help from the IQP team members. Teaching will focus on natural history and scientific analysis. Students will learn to make observations and collect samples in the field and will have opportunities for hands-on learning in the school sessions during which, for example, experiments in water quality testing, invertebrate sampling and bacterial plating would be introduced. Students will learn to make connections between actions and outcomes, e.g. sewage treatment and coliform counts. They will also gain skill in formulating questions and seeking information about remedial activities in which the community might participate as they interact with professionals at their various field sites.

Outcomes: The specific aims and outcomes of the program include objectives for both program participants and the community served. The objectives for participants include:

1. Specifically introducing participants to the issues of water quality and water pollution

2. Giving participants an expanded concept of their role in and impact on the

environment, both local and global

3. Empowering participants to affect change in their community through education and awareness programs

4. Providing tangible evidence of the program's role in the community through storm drain stenciling and Earth Day clean up.

5. Linking personal reflection and growth to global change through dissemination to other sites via the internet

6. Connecting past behaviors to current problems and current behaviors to future change.

The objectives for the community service component include:

1. Educating families about local issues regarding environmental and water quality within the Blackstone River watershed

2. Increasing awareness and understanding of the impact of local behavior on the broader community (watershed area) and its environment

3. Enhancing the visibility of youth community service in the city by modeling positive change initiated by "teenagers"

Sample schedule for participant in *Waterworks*: Since the group will be divided into two teams, a sample for each team is given, one in plain type, the second in Italics. For the second group, time is designated as reflection, training or service related.

3:30- 3:50 Assemble and board transportation and travel to Bell Pond, one of the original water supplies for the city.

Assemble and spend five to ten minutes writing short observations/ impressions from the previous week's field trip. Break into small groups to compare thoughts and reflections.(REFFLECTION TIME) Define the take home message for the week. Design a verbal and visual piece for the web site and for potential use in the education seminar (SERVICE TIME).

3:50-4:15 Collect water samples from various areas of the pond. Working with the teacher/naturalist, make and record observations of the area. Hypothesize what things have changes in the past that may have affected water quality. Make a draft map of the area.

Set up for analysis of water samples collected the previous week. Learn

techniques for monitoring pH, dissolved oxygen. Sieve samples and observe collected specimens (TRAINING TIME).

4:15-4:35 Complete collection and observation. Compare results. Catalog samples and specimens and discuss proper storage for future analysis. Package samples for return to school.

Record data and observations. Discuss options for presentation of data and conclusions which can be drawn. What has your assessment taught you about the water? (REFLECTION and SERVICE TIME)

4:35-5:00 Return to school. Store samples away for future use. Discuss preparations for next week.

Complete data collection and recording. Clean up. Discuss what differences your data has from that which might have been collected at various times in history and why (REFLECTION TIME).

Saturday session examples:

Storm drain stenciling visit to Worcester's water filtration plant

Earth Day clean-up Tatnuck watershed reconnaissance

Community Education Day at Seven Hills

Accessibility to persons with disabilities

Seven Hills Charter School welcomes all students, parents, employees or visitors, regardless of age, race, sexual orientation, religious affiliation , gender or handicap who wish to participate in the life of our school community. Our school accepts and embraces all its members and the physical plant reflects this conviction in its handicapped-accessible design.

III. Participant Development:

Recruitment: Because participants come from a defined group- the student body at the Seven Hills Charter School- recruitment will be done through the school network. The school is a free, public school, open to residents of the city of Worcester. There are 662 students in grades K-8, with 227 in grades 6-8, the audience for this program. The current school population includes 2% native Americans, 19% African Americans, and 22% Hispanic students. 17% of the students have IEPs on file and 45% qualify for the free or reduced lunch fee program.

Every family in the school is provided with a home computer which is networked to the school via The Common, the Seven Hills computer network system. All families are given computer training and are expected to log on to the network to access information about school policy, events, and other information on a routine basis. Mailing lists for specific groups can be assembled by the school's technology office on an as needed basis. A program announcement will be e-mailed to every family with a child entering grades 6-8, the Junior Academy at Seven Hills. Applications can be filled out electronically and returned to the program director at Seven Hills. If there are more interested students than the program can accommodate, the applications will be divided into single gender groups and equal numbers will be selected from each group by lottery. This will assure that an equal number of female students will be exposed to the science and inquiry based approach provided by this program. The Junior Academy's science director has specifically requested that this be done, based on the National Science Foundation's recommendation that active approaches be adopted to insure the inclusion of female students in science and inquiry learning, particularly at the junior high school level where student interest in science often drops off.

The two objectives for student participant development are in the areas of education and empowerment. Education in concrete measures such as water quality and less tangible concepts such as cause and effect will happen throughout the program. All educational goals will be met through active, hands-on, and inquiry based learning. Students have clearly indicated their preference for active roles in learning, and the program will be structured to accommodate those preferences. Even reflections will become active when they are prepared for inclusion in web site updates and community education materials. Under the guidance of the program directors and the IQP team members, students will continually integrate information into a total picture which they will prepare in an ongoing way for their final presentation. Construction of a web site with weekly updates and calendars will also provide a means to visualize the progress and integrate the activities over time.

Empowerment is an important part of participant development. One of the objectives of the community education seminar is to give students ownership of the service component of the project. Students will be responsible for planning, format, preparation and presentation of their final seminar. They will be encouraged to think about their audience and predict what approaches they can best use to persuade that audience to care and to change. There is no better way to learn and really understand something than to teach it to someone else. Tying behaviors to outcomes and education to change are useful approaches to many social and community issues. Hopefully students will leave the *Waterworks* program with a sense that they have accomplished something. That sense will be reinforced every time they see a storm drain stenciled with "Don't dump! This

drains into the Blackstone River."

IV: Evaluation and Continuous Improvement

Surveys of information and attitudes before the start of the program and monthly during its duration will be carried out by the IQP team. One of the IQP requirements is to learn to construct surveys and analyze data. Planning for the evaluation aspect of the project will begin as soon as the IQP team is recruited for the project. While some of their data collection may be by questionnaires, other measures will be less direct. Asking one group of students to design a crossword puzzle or Frequently Asked Question (FAQ) file for the web site, and the other to write the answer the following week might be one clever way to assess ownership of information. Because the development of the web site and the educational presentations will be ongoing, the IQP team members who will have direct oversight of these activities can use them to monitor both interest and attitudes of student participants. Monthly meetings of the supervisory team will be held at which presentations of outcome data will be discussed and programmatic changes made to deal with unmet objectives. The inclusion of college students in the project is designed to provide not only positive role models for student participants, but also avenues of communication that might not exist with adult participants who are perceived as teachers. Final evaluation of program objectives will include community reaction to the educational sessions, assessed by number of attendees and answers to specific questions which will be solicited by questionnaires and interviews of community participants . Counters will be put on the web site to see how often it is accessed. Reminders about the site will be sent out on The Common routinely. Final evaluation of the project, including statistical analysis of the outcome data, will be done by the IQP team and included as part of their required presentation of their project to the WPI community.

Organizational capacity:

The Edison Project, which serves as the management team for the Seven Hills Charter School, considers its schools to be community centers. Our philosophy is that community service activities give important opportunities for connecting the school to its community. One of the staff positions in the school is that of Community Resources Director. Because Seven Hills is a newly established school, we do not have a long track record of community service, but are anxious to make positive strides in that direction. The school administration sees this program as an essential part of educating children to be active members of their community, both within and outside the school. Partnering with Massachusetts Audubon, which has a long history of education and advocacy, will lend strength and experience to the project. Each year Mass Audubon's educators provide over 600 environmental education programs to diverse audiences. This project is well suited to their conservation mission and to their educational strengths. Likewise,

WPI has had, since the 1970s, an ongoing commitment to teaching its graduates to understand, as professionals and citizens, how their work will affect the larger society of which they are part. Thus the IQP concept is based in community service and has included both environmental and educational divisions since its inception.

Discussions among the participants has included specific attention to providing diversity in staffing. The Audubon director has already begun the process of identifying specific professionals who will be included as on-site supervisors for field sites with an eye to exposing the children to both women and minorities working in the field. Parent volunteers will be recruited from Seven Hills and encouraged to join students on Saturday field trips to act as transportation and field supervisors. These parents will represent the diversity of participants in the program (see recruitment data) and will also serve as part of the audience for community education.

Funds to sustain the program will be sought from local foundations and corporations. Potential sponsors will be invited to the final educational seminar to see the positive outcome of the program. Additionally, members of the Board of Directors, (see attachment) many of whom are connected to local foundations and corporations, will be solicited for ideas about and connections to potential funding sources.

Q: Paulette: I need answers to the questions about fiscal oversight, management, auditing (pg. 11)

VI. Community Assets and Partnerships:

The Seven Hills Charter School is one of a group of (#) schools throughout the country which is managed by the Edison Project. Edison provides networking among its schools for students, faculty and administrators and families. This networking can be done electronically among all sites. Edison is committed to facilitating communication at various levels within the organization as one part of building a sense of community. Seven Hills also provides a school environment with a security system to assure safety even during after school hours, as well as science laboratories for hands -on learning. and a computer classroom in which all participants can have access to the schools computer network and software.

Mass Audubon is currently collaborating with the National Parks Service and the Blackstone River Valley National Heritage Corridor Commission in guiding the development and use of the 250,000 acres which comprise the Heritage Corridor including the Blackstone River and its tributaries. National Park rangers will likely be instrumental in guiding field trips within the corridor for this program. The Commission has already produced maps and guided tours of many of the waterways and historic sites which will be beneficial in investigating the natural

history associated with the water resources in Worcester.

WPI has a long history of engineering, science education and technology. It supports a number of interdisciplinary environmental programs, including the Biology and Biotechnology Environmental Science Program. Conservation ecology projects in this division include collaborations with both Mass Audubon and the Massachusetts Division of Fisheries and Wildlife. Faculty in the Social Science and Policy Studies Department also provide advising in development of appropriate assessment for social science research as part of the training for IQP work.

TOP
Back to the main page

The Survey has been fixed. Its up and running! Please help us out and evaluate this program and the web page!

WaterWorks Service Education Program Survey	Home	water quality information

Please take your Time, and look through the Page before answering this survey!

thanks!

(optional) please enter your name:

First: Last:

Your Return E-mail Address:

Why did you visit our page?

Do you live in the Blackstone River Watershed?

- Yes
- No

1) The water in the Worcester, Massachusetts area is:

- Acidic (pH < 7)
- Basic (pH > 7)
- About Neutral (pH ~ 7)
- I Don't Know

2) The shower heads in my house are water saving shower heads:

- Yes
- No

- I Don't Know

3) Bacteria in the water can cause (choose one):

- Ear Infections
- Stomach Ulcers
- The Flu
- I Don't Know

4) I can have a significant impact on the water quality of the ocean:

- Yes
- No
- I Don't Know

5) Which of the following are true:

- High turbidity makes it difficult for plants to grow in water.
- Fertilizer run-off can make plants in water grow too much.
- Both of the Above
- Neither of the Above
- I Don't Know

6) Was this site well laid out and organized?

- Yes
- No
- Lacks a Little Organization
- Lacks Major Organization

Please give us your comments on the organization of the page:

7) If you were going to teach a unit on Water Quality and Conservation, would you consider using this page to help?

- Yes
- No
- If It Were More Informative
- If It Were Less Informative

What Other Information Should the Program Cover? What Should Be Removed?

8) How difficult was it to find the Answers to #1-#5 on this page?

- Very Difficult
- Somewhat Difficult
- Somewhat Easy
- Very Easy

9) How would you respond to this statement?:

"A student who has completed this program will be aware of how his/her daily actions will affect the water quality in the watershed around them."

- Strongly Agree
- Agree
- Disagree
- Strongly Disagree

10) How would you rate this model site and program as a tool for learning about and teaching water quality to others?

- A Poor Tool
- Good Idea But Lacking Some Minor Points
- A Satisfactory Tool
- An Excellent Tool

Please Add Any Comment About Any Aspect Of the Site! Your Input Is Very Helpful and Appreciated!

Submit Clear

Any futher questions or comments?? Please E-mail us!!

BACK

How to set up a Water Works program in your school:

This water conservation program is designed as a collaboration between a school, to provide the participants and a weekly meeting place, and a conservation group, such as the Audubon Society or other organization capable of providing education to the students. If possible try to include a local college to handle technical and assessment aspects of the program. Funding for the project, if needed. should be sought through your state's community service and education programs. As shown on the example page, it is advantageous to take frequent trips to local bodies of water so that the students realize that the problem is local, and that they are capable of changing it. To gauge how bad the water quality problem is, it may be useful to take water samples and do basic quality analysis. A page in the web-site has been included to help understand the data, consult a science text on how to do the tests. The students should quickly learn that direct action on the part of the individual and changes in water-use habits are the best means of making a difference. It may be advantageous to assess the effectiveness of the project through the use of a quiz, given at the beginning and again at the conclusion of the project. More data can be collected by the college students if applicable to your program. An example of such a quiz is provided on the sample web-page. If sufficient time and resources are allowed, it is suggested that the group build a web-page, with help from a college (if applicable), containing their collected data and any actions undertaken to help the watershed. One of the students wrote a letter to try to get an oil-contaminated site cleaned up. efforts like this should be rewarded and noted on the site.

This program is designed for a group of 20-30 students, meeting once a week for an hour and a half so the affected group of people would normally be small. It is encouraged that the students set up a community education piece of some sort. The effort could be minimal and passive, like a pamphlet or flier. For a limited budget, signs above storm drains warning people what body of water they pollute by dumping there. A more involved example would include a parent's night at the school, preferably a walk through exhibit, and/or an earth day booth at a local festival, rather than a lecture. These education pieces are just some suggestions and were tried by the group of students we worked with.

When attempting to do such an education piece at your school, be sure to keep in touch with all of the groups involved, set up meetings to discuss progress and stay on track. It is important that the focus stay on keeping the students interested, so that the knowledge they acquire is not forgotten and that it is passed on.

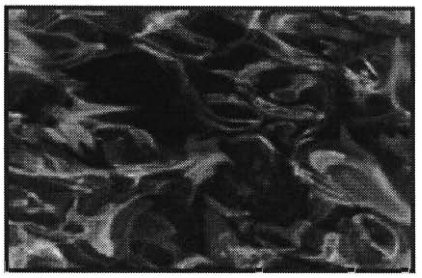
: Good communication is essential to making the program work. The original grant specified monthly meetings to discuss the progress of the program. It can not be overstated that this is a minimum and we feel meeting should be held as often as possible and conveinient for all parties involved.

This project is ideally performed by 20-30 students spending one and a half hours a week after school either collecting data or being educated through in class activities like a mock town meeting discussing sewage treatment options and occasional weekend trips. It is ideal for students that have a community service requirement for graduation at their schools. Please take the time to inform yourself about how the whole thing works by reading the grant that directed our project and the page dedicated to the scientific data about water quality. If you would please fill out our survey/quiz we

would be grateful.

Thank you for your time.

BACK



See what water quality facts the kids have learned by clicking here!

or, click below to look at specific topics

Dissolved Oxygen Concentration

BioChemical Oxygen Demand

Fecal Coliform Bacteria Count

pH

Water Temperature

Total Phosphorus Concentration

Total Nitrate Concentration

Turbidity

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