



An Investigation into Worcester County's 'Troubled Waters'

An Interactive Qualifying Project
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By

Kevin Gagnon

Ryan Keough

Marshall McGoff

Project Advisors: Robert Thompson
Susan Vernon-Gerstenfeld

ABSTRACT

The goal of this project was to establish and evaluate the problems in Worcester County's wastewater and investigate what was being done to remedy the situation. Through many means of data collection including first hand interviews, budget analysis, and government document collection, we discovered key areas that are responsible for the problems Worcester County is facing. We concluded that there are two main issues from which all the problems in wastewater treatment stem. Budget cutbacks and labor shortages are crippling the MassDEP and EPA. All problems with the procedures and equipment in the environmental strike force can be traced back to these issues. To discover what was being done about the problems, we searched through government records to see what legislations, if any, were being passed through congress to combat these issues.

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ACRONYMS

BHWSCP - Board of Hazardous Waste Site Cleanup Professionals

CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act

CFR - Code of Federal Regulation

CSO – Combined Sewer Overflow

CWA – Clean Water Act

CWSRF - Clean Water State Revolving Fund

EOEA – Executive Office of Environmental Affairs

EOEEA – Executive Office of Energy and Environmental Affairs

EPA – Environmental Policy Agency

FWPCA - Federal Water Pollution Control Act

IQP – Interactive Qualifying Project

LQG – Large Quantity Generator

LSP – Licensed Site Professional

MassDEP - Massachusetts Department of Environmental Protection

MCP – Massachusetts Contingency Plan

MEPA – Massachusetts Environmental Policy Act

MSDS - Materials Safety and Data Sheet

MWRA – Massachusetts Water Resources Authority

NPDES - National Pollutant Discharge Elimination System

PISCES - Performance and Innovation in the SRF Creating Environmental Success

SPCC – Spill Prevention Control and Countermeasure

SQG – Small Quantity Generator

USGS – United States Geological Survey

USPIRG – United States Public Interest Research Group

VER- Vacuum Enhanced Recovery

VOC – Volatile Organic Compound

WPI – Worcester Polytechnic Institute

GLOSSARY

1,1-dichloroethylene - an organochloride with the molecular formula $C_2H_2Cl_2$. It is a highly flammable, colorless liquid with a sharp, harsh odor.

1,2-trans-dichloroethylene - an organochloride with the molecular formula $C_2H_2Cl_2$. It is a highly flammable, colorless liquid with a sharp, harsh odor.

Allyl Alcohol - a colorless liquid, C_3H_6O , having a pungent, mustardlike odor irritating to the skin and mucous membranes, usually obtained from allyl chloride by hydrolysis: used chiefly in organic synthesis in the manufacture of resins, plasticizers, and pharmaceuticals.

Allyl Chloride - a colorless, volatile, flammable liquid, C_3H_5Cl , having a pungent odor, derived from propylene by chlorination: used chiefly in the synthesis of allyl alcohol, resins, and pharmaceuticals.

Aniline - A colorless, oily, poisonous benzene derivative, $C_6H_5NH_2$, used in the manufacture of rubber, dyes, resins, pharmaceuticals, and varnishes.

Aquifer – area of land with a high concentration of water underground, very easily contaminated.

Benzene - A colorless, flammable, liquid aromatic hydrocarbon, C_6H_6 , derived from petroleum and used in or to manufacture a wide variety of chemical products, including DDT, detergents, insecticides, and motor fuels.

Byproducts – chemical products produced during a reaction.

Combined Sewer Overflow – an apparatus built into a combined sewage network. The arrangement is designed to allow a certain amount of flow to discharge into a water course untreated to keep the system from becoming surcharged in storm conditions.

Contingency Plan – a program of action designed for handling possible future circumstances or events.

Dibenzofurans - a family of organic compounds that have atom or group substitutions made for the hydrogens on any of the numbered carbon atoms in the dibenzofuran structure.

Drinking Water – can be defined as any water that is suitable for drinking, often stemming from groundwater sources.

Exceedance – the amount by which something, especially a pollutant, exceeds a standard or permissible measurement.

Fecal – pertaining to feces.

Fecal Coliform Bacteria – are bacteria present in the intestines of humans and many animals whose presence in water suggests fecal pollution.

Fluoride – Chemical byproduct of hydrofluoric acid dissociating in water.

Groundwater – can be defined as water beneath the earth's surface, often between saturated soil and rock, which supplies wells and springs.

Homogenous – same concentration of material throughout.

Hydrochloric acid - A very strong acid that fully dissociates in solution. Very harmful to humans and other wildlife.

Hydrologist – a geologist skilled in hydrology.

Hydrology – the scientific study of the properties, distribution, and effects of water on the earth's surface, in the soil, and underlying rocks, and in the atmosphere.

In-situ - where a clean up or **remediation** of a **polluted** site is performed using and simulating the natural processes in the **soil**, contrary to **ex situ** where contaminated soil is **excavated** and cleaned elsewhere, off site.

Knowing violation – introducing harmful pollutants into the natural environment when one knows it will have negative effects on the surrounding areas.

Large Quantity Generator – a facility that generates more than 2,200 lbs of hazardous waste or more than 2.2 lbs of acute hazardous waste per calendar year.

Municipal facilities – wastewater treatment plants owned by the town.

National Pollutant Discharge Elimination System permits - controls water pollution by regulating point sources that discharge pollutants into waters of the United States.

Nitroaromatics – a family of compounds that are aromatic molecules with any number of NO₂ group substitutions for the hydrogens on it, and example would be Nitrobenzene.

Nitrobenzene - A poisonous organic compound, C₆H₅NO₂, either bright yellow crystals or an oily liquid, having the odor of almonds and used in the manufacture of aniline, insulating compounds, and polishes.

Organic – a compound made up of any combination of carbon and hydrogen, oxygen, or nitrogen.

pH – the negative log of the hydrogen ion concentration of a solution. Neutral pH is 7.

Plume – the area covered in contaminated material.

Point Sources - discrete conveyances such as pipes or man-made ditches.

Potentially Responsible Party – Person in ownership of or responsible for hazardous chemicals.

Remediation process – the process by which accidents are cleaned up.

Small Quantity Generator - Generate in a calendar month more than 220 pounds (100 kg) but less than 2,200 pounds (1,000 kg) of non-acute hazardous waste. As an estimate of liquid waste or generate in a calendar month less than 2.2 pounds (1 kg) of acutely toxic or severely toxic hazardous waste.

Toxic waste – potentially poisonous materials that are harmful if handled incorrectly.

Triangulation – the application and combination of several research methodologies in the study of the same phenomenon (Triangulation in Research 2007.)

Volatile Organic Compounds - are organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere.

Wastewater - Water that has been used, as for washing, flushing, or in a manufacturing process, and so contains waste products.

Xylene - any of three toxic flammable oily isomeric aromatic hydrocarbons C_8H_{10} that are dimethyl homologues of benzene and are usually obtained from petroleum or natural gas distillates.

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INTRODUCTION

Groundwater contamination has been a well-documented problem and can cause even more problems than contaminated drinking water (Westrick and Mello 1984; Trauth and Xanthopoulos 1997). The harmful organic impurities found in the polluted water cannot only seep into drinking water and reservoirs, but they can also damage environmental reserves, ruin agricultural plots, and kill wildlife in the area. Infected animal and plant life can be especially detrimental to human health through consumption. Environmental regulations have been implemented due to the great danger to life that industrial discharge poses (Lewis 1985).

Despite these regulations, organic contaminants still enter into the surrounding environment from industrial plants. In a recently released article by the Environmental Protection Agency (EPA), the city of Fitchburg was fined \$137,500 for repeated discharges of untreated sewage into the North Nashua River (Merchant 2001). While in sewer overflow cases it is common for heavy weather to cause sewage discharges, the release of this sewage occurred during dry weather. Contaminations can be attributed to faulty equipment, human error, or negligence; however, in this case it was clear that the violations were due to faulty and aging equipment.

In the event of an accident, it is the responsibility of the company to report the incident in a timely manner as outlined by the law. Once the accident has been reported they must arrange for, and fund the clean up. It is also the responsibility of those who enforce government regulations to ensure that the accident is being properly handled and that precautions are being taken to prevent future accidents. Accidents can occur from various causes, not just human error; a few examples of accidents are contaminations

attributed to degrading aged piping, leaks from compromised containers, or disregard for protocol.

In the ideal situation, an accidental spill of harmful organics would trigger a contingency plan, which when followed would instantly remediate the problem resulting in none of the pollutants making it out into the environment. The reality is far from this, as some companies fail to have any backup plans in case of emergency (Coletta February, 2006). Contingency plans are absolutely essential for the safety of the environment. If an accident were to occur, and no contingency plan were established, contaminants could leech their way into the environment, and once there, do considerable damage before a clean-up plan was even proposed. If too much time passes between the time of accident and the beginning of the clean-up process, remediation techniques become extremely difficult, in some cases impossible (Massachusetts Department of Environmental Protection (MassDEP) May, 1999).

In the case of the town of Fitchburg, the reason behind the large fine is predominantly because the town has been aware of the issues with their system for years and had not taken any actions towards improvement (Merchant 2001). This facility, and the entire class of wastewater treatment facilities, are all governed by EPA issued permits called National Pollutant Discharge Elimination System (NPDES) permits. Recently the United States Public Research Interest Group (US PIRG) released a study on facilities exceeding their NPDES permit limits nationwide. On this list, Worcester County is ranked as number two for most exceedances (Leavitt 2006). The issue in the town is that there are two treatment facilities both of which have not been updated since 1968 (City of Fitchburg 2007). These facilities were designed with 10-20 years of function in mind;

with technology changes, population increases, and policy changes it is not difficult to see how these facilities can be severely out of date and drastically in need of updating.

These recurring problems raise many concerns about the effectiveness of the regulations put into place. Finances, officials' qualifications, and the efficiency of the current wastewater facilities are all factors that bear investigation in determining the effectiveness of present practices. Certain steps of the cleanup and accident prevention process are very expensive and not all towns may be able to afford remediation procedures and equipment. Financial inability of not only the towns in question, but also the MassDEP and EPA themselves needs to be considered, and even more importantly the peoplepower of these agencies, needs to be investigated.

The officials involved in the cleanup process are referred to as licensed site professionals (LSPs). They are responsible for the evaluation of the sites in question and the final review of previously contaminated sites. The reports done by the LSPs are submitted to either the MassDEP or the EPA depending on the circumstances of the accident. These professionals must be certified by the Board of Hazardous Waste Site Cleanup Professionals (BHWSCP) and maintain a current license. However, a study of the testing methods and the overall proficiency of the officials need to be explored although, the scope of this project does not go in depth into this.

The main focus of this project was the government's involvement in the wastewater cleanup and the prevention of accidents relating to wastewater in the state of Massachusetts. Mainly, we determined what is being done to remove Worcester County from its abysmal standing in the US PIRG report on the number of NPDES permit violations (Leavitt 2006). An initial aspect of this project was going to be an

investigation into the private sector; however, after some preliminary data collection we realized that the focus of this project was shifting slightly. We had thought that our main focus was going to be based around industrial facilities; however, we discovered that no matter what the industries are pumping out of their factories, it is the municipal water facility's responsibility to make sure that the output into the community is within the defined permitting levels. Certain Large Quantity Generators (LQG) industries have on-site treatment facilities, such as Wyman Gordon, and these facilities are subject to town issued permits as well as federal issued NPDES permits. Since the driving force for our project has been the USPIRG report "Troubled Waters," which lists Worcester County as the second worst county in the nation with respect to these permitting levels, it was clear that we must also ferret out information from the municipal facilities.

The USPIRG report pertains to municipal wastewater treatment facilities. Although it is industries that may be initially discharging the harmful contaminants to the treatment plants, it is the responsibility of the water treatment plant to issue permits to the industries according to what the facility can handle and then discharge fully treated water. The MassDEP and the EPA are charged with monitoring the municipal wastewater treatment plants. We ultimately intended, in this paper, to show that the government's involvement through these environmental agencies is necessary but difficult. The ever diminishing budget for wastewater enforcement, treatment, and restructuring makes for one problem, the redundancies in-house reducing the peoplepower force behind these enforcers is a second problem, and a third problem underlies in the constant battle with the federal government for policy issues.

LITERATURE REVIEW

Water is one of the most abundant resources on the planet; however, due to its necessary involvement in industrial chemical processes, contamination of water is a concern. As a result, strenuous industrial level precautions are used to make sure that the hazardous water generated by certain chemical reactions is contained properly until it can be cleaned and released into the environment. The government on both the state and federal level has set up laws to ensure that the precautionary measures are adhered to. Despite all of the safety measures and laws, harmful contaminants do penetrate the environment. When this occurs, it is the responsibility of the industry to clean up the toxins quickly and efficiently; however, it is the responsibility of government organizations, such as the Massachusetts Department of Environmental Protection (MassDEP), to ensure that the most effective site remediation methods are utilized and in a timely manner.

According to a recent national study, Worcester County is among the top five counties in the nation exceeding their clean water act permit limitations (Leavitt 2002). The following sections will provide background information on the dangers of contaminants, the laws that safeguard and provide standards for remediation of a contaminated site, and how the specific government agencies handle these accidents.

Toxicity Analysis

It is evident that governments around the world understand the severity of organics contamination in public waterways. Recently reported by Chemical and Engineering News (Tremblay 2005), the city of Harbin in China shut down its water supply due to upstream contamination by a chemical plant. Analysis of the contamination

showed that the compounds benzene, nitrobenzene, aniline, and xylene all entered into the sewer system. This problem can be seen as severe when the damaging aspects of these compounds are analyzed even briefly. Benzene is a proven carcinogen in humans (Material Safety and Data Sheet [MSDS] 2005). Nitrobenzene is known to be toxic to the blood, kidneys, liver, lungs, and mucous membranes in humans (MSDS 2005). Aniline is a proven carcinogen in animals (MSDS 2005). Xylene is also shown to be toxic in humans in blood, in the liver, kidneys, and the nervous system (MSDS 2005). These compounds are clearly problematic if introduced into the environment in excessive quantities.

In 2004, in Dalton, GA, there was “a runaway chemical reaction and vapor cloud release” of allyl alcohol and allyl chloride (Hess 2006). Signifying the severity of this accident, 154 people needed to be decontaminated¹ because of chemical exposure; allyl alcohol is considered to be extremely hazardous through skin contact and inhalation (MSDS 2005). Allyl chloride on the other hand is a proven carcinogen to animals (MSDS 2005).

One of the EPA’s largest budgeted funding goes towards the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), more commonly known as the Superfund program. The Superfund sites are examples of severely contaminated sites, one of which is the Fort Devens site in Devens, MA. This site had been contaminated with Nitroaromatics, Volatile Organic Compounds (VOCs), and Dibenzofurans among other things (Superfund 2006)².

¹ Refer to MSDS for decontamination process

² More information on the current status can be found at <http://cfpub.epa.gov/supercpad/cursites/csitinfo.cfm?id=0100966>

As of March 2006, Worcester County, Massachusetts was known as one of the top five counties in the nation with facilities exceeding their Clean Water Act permit limits for wastewater (Leavitt 2006). This problem is further evidenced when chemicals, such as 1,1-dichloroethylene, one of the top five organic industrial contaminants, are shown to be released into the local bodies of water (MassDEP 2005). The MSDS for this particular chemical shows that it is known to be moderately toxic to aquatic life and algae. In humans, this compound is known to cause a wide spectrum of problems including liver damage, kidney damage, or tumors. Another chemical from this list that has also appeared in Worcester accident reports is a similar compound, 1,2-trans-dichloroethylene. This compound's ecological effects, unlike the previous toxins, are unknown; its human effects are not quite as severe, causing symptoms such as vomiting and drowsiness.

Other recent accidents show contamination of chemicals such as sodium hypochlorite, better known as bleach (Coletta February, 2006). Sodium hypochlorite is known to be immediately dangerous, causing such things as lung damage and severe skin burns. It is also known to be toxic to aquatic life and animals. Bleach is listed as an extremely hazardous substance in the community right-to-know section of the Code of Federal Regulation (CFR).

Fecal coliform has been shown through the United States Public Interest Research Group (USPIRG) report to be one of the most abundant pollutants found in the environment. Fecal coliform is a bacterium found in fecal matter and human sewage. This bacteria has many adverse health affects including diarrhea, the spread of disease, cramps, nausea, and headaches (Drinking Water Contaminants, 2007).

Laws Regarding the Safety of the Environment and the Public

On both the state and federal level, government institutions have passed a plethora of regulations to help ensure the safety of our working waterways. This legislation spans from regulations on funding, to protocol for wastewater handling. To understand the effectiveness of the government, one needs to understand the legislations that they passed.

Federal Laws

To ensure the safety and health of the environment and the public, the Environmental Protection Agency (EPA) proposes and enforces laws on a Federal level. One of the laws passed in 1948 by the United States government concerning the integrity of the natural environment was the Federal Water Pollution Control Act (FWPCA), which empowers the EPA as its administrator. This law has been revised numerous times in the past decades, with the last revisions in 2002. One of the primary goals of the FWPCA is to preserve and protect the natural environment from harmful pollutants. In order to do this, the FWPCA states that there must be control and regulation on the amount of pollutants introduced into the environment and, in the case of contamination, must plan “to prevent, reduce, and eliminate pollution” (EPA 2002).

In order to establish programs for the treatment of water pollution, the EPA is responsible for conducting an investigation in cooperation with other federal agencies, the state water pollution control agency, and the industry involved (EPA 2002). The investigation is necessary to determine how to control the pollution at hand, what storage

is needed to contain the water pollution, and the means to treat the pollution, along with the economics of controlling the pollution.

The FWPCA also includes the names of pollutants that are damaging to the natural environment and the public's safety. It is very important to know which organics are harmful especially when surveying the local environment for any pollutants. The FWPCA states that the state water pollution control agencies must survey and examine samples of water to ensure that there is little or no evidence of pollutants found (EPA 2002). This is required to allow the EPA to keep records of which bodies of water may be polluted. The EPA is responsible for analyzing the pollution reports prepared by the states. The states must complete this analysis every three years, along with obtaining new scientific knowledge about the effects of pollutants on the environment.

Violations against EPA regulations are first dealt with on a state level. One type of violation is negligence by the parties involved. Negligence can be defined as the release of harmful contaminants due to human error, but not intentionally. For instance, if toxic organics are discharged into the environment through a pipe that was installed incorrectly, then it is considered negligence. Another type of violation is a "knowing violation," which can be defined as introducing harmful pollutants into the natural environment when one knows it will have negative effects on the surrounding areas. An example of this type of violation would be a company that intentionally dumps its chemicals into nearby waterways.

Massachusetts' State Laws

Along with following the laws set forth by the EPA, Massachusetts also creates and enforces its own laws. One of the agencies found in Massachusetts that monitors the condition of the environment to ensure the safety of the natural environment and the public is the Executive Office of Energy and Environmental Affairs (EOEEA)³. Representatives of the MassDEP, a subdivision of the EOEA, are responsible for “ensuring clean air and water, safe management of solid and hazardous wastes, timely cleanup of hazardous waste sites and spills, and the preservation of wetlands and coastal resources” (Coletta 2006).

To classify and ensure that waterways are being protected from harmful substances, Massachusetts put into effect the Department of Environmental Protection law 310 CMR 9.00: Waterways (MassDEP 2000). This law was enacted in order to protect and encourage the public’s interest in the state’s waterways, which include tidelands and non-tidal rivers and streams, along with protecting the public health, safety, and general welfare corresponding with these waterways (MassDEP 2000). To ensure the safety of the waterways from an environmental and public viewpoint, the project in question must have the appropriate permits and licenses to conduct activities.

Accidents

Federal and state legislatures have set forth all of the aforementioned regulations to ensure the safety of the public, and the protection of the environment; however, the reality of the situation is that contamination does occur. In the event that harmful organic

³ During this project the Executive Office of Environmental Affairs (EOEA) underwent an internal restructuring and was renamed the Executive Office of Energy and Environmental Affairs (EOEEA)

contaminants enter the surrounding water, steps need to be taken to ensure the quick, efficient removal of the pollutants.

Licensed site professionals (LSPs) are responsible for accessing the site for contamination, what work is required to clean the site up, and whether that work has already been completed. The LSP profession was established to place more responsibility for cleaning up sites on the private sector and to provide the MassDEP extra personnel to complete remediation of sites that have been backlogged for years. To become an LSP one must have eight or more years of total professional experience, of which at least five years must be experience relevant to the field of waste site cleanup (LSP 2003).

The MassDEP keeps a detailed record of the accident reports. These reports are maintained on the MassDEP website and are available to the public online. The reports on the online database go back only to 1993 but reports filed before are available for download.

METHODOLOGY

The goal of this project was to analyze the problems in Worcester County's industrial wastewater management systems. We focused on the fact that Worcester County is among the top five counties in the nation with major facilities violating their Clean Water Act permits (Leavitt 2006). Specifically we investigated why Worcester County is ranked so poorly in the nation, who is informed of the statistic, and what is being done to remedy the looming problem.

To assess the alarmingly high ranking of Worcester County regarding Clean Water Act exceedances we examined publicly available reports and conducted personal interviews. We focused on the raw data of the reports rather than on conclusions. The team also determined if the information was up to date, and if the data was not up to date, we ferreted out the most recent figures. Interviews were conducted with government officials, private contractors involved with the inspection process, and on-site company administrators. These interviews were directed towards discovering the interviewee's awareness of the situation, and finding out what is being done to change the current protocol in response to this inadequacy.

Raw Data Collection

A large majority of the raw data came from government institutions, such as the Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental protection (MassDEP), and from other organizations such as the United States Public Interest Research Group (USPIRG). This information can be considered raw data because it is only the data without any conclusions. The data were gathered

through a variety of publicly accessible databases and helped to illustrate the severity of the problem.

Interviews⁴

Armed with the raw data, the team sought out professionals involved in all aspects of wastewater treatment.

We interviewed Dave Messier, who is the safety administrator for WPI and is responsible for ensuring the safe handling of chemicals in all of the labs at WPI, and properly removing toxic waste from campus in a safe manner. The goal of this interview was to see how strict standards are towards an entity in the private sector. We asked questions geared towards learning about the frequency of MassDEP interactions and what these communications are. We also inquired about the protocol for obtaining permits from the MassDEP and the standards to which these permits hold the university. Previous research had shown that there had been an incident on campus requiring MassDEP action and that accident as well as what kind of steps were taken to remediate that problem, were discussed. Mr. Messier also gave us a tour of the WPI pH stabilizing facility, in the basement of Goddard Hall.

We spoke with Joel Loitherstein, a licensed site professional (LSP) who also owns his own environmental engineering firm. The purpose of speaking with Mr. Loitherstein was to gain insight into how chemical spills are dealt with from a MassDEP standpoint. The questions asked to Mr. Loitherstein were tailored towards finding out firsthand how accidents and spills are remediated in the industrial sector and what the LSP profession is. Specifically, we wanted to discover how the LSP profession, which is a separate entity from the government, interacts with the MassDEP and the EPA.

⁴ For complete transcripts of the interviews, see Appendix A.

Because the LSPs are the on-site authority on cleaning up industrial spills, we wanted to discover how one becomes qualified to carry out the job.

Whilst interviewing Mr. Loitherstein we also spoke with his wife, Massachusetts State Senator, Karen Spilka. The purpose of speaking with Senator Spilka was to determine if there were any current policy changes in the State Senate that may affect wastewater management issues. Before becoming a state senator, Mrs. Spilka worked as a labor lawyer for Massachusetts Water Resources Authority (MWRA). Because of this background, we knew that she would be an excellent resource to ferret out the intriguing policy issues involved with wastewater treatment.

For insight on the inner workings of the infrastructure of the MassDEP, we interviewed MassDEP official Paul Hogan. We designed questions to obtain information on how the MassDEP works with other organizations, such as the EPA, and related personnel such as LSPs. It was brought to our attention upon arrival that Mr. Hogan in particular deals with National Pollutant Discharge Elimination System (NPDES) permits. Specifically, Mr. Hogan deals with permitting conditions, not the enforcement aspect. With this new information, we geared questions towards finding out how to obtain permits and the conditions of operating with one.

We interviewed Damien Houlihan from the EPA Region 1 in Boston. He is the team leader for the industrial permitting branch. We asked him many questions regarding contingency plans for accidents and the ability to operate without one. We also inquired to the relationship between the MassDEP and the EPA. Another issue that we discussed with Mr. Houlihan was combined sewer overflow (CSO).

We held an impromptu interview with Brian Pitt and David Pincumbe. Brian Pitt is Damien Houlihan's counterpart in the municipal permitting department. David Pincumbe works in the laboratory for the EPA. We asked the same type of questions to Mr. Pitt and Mr. Pincumbe as we did to Mr. Houlihan. This series of interviews reinforced the idea that we needed to change our focus to municipal facilities.

Although we had shifted gears towards municipal facilities, we still wanted to interview someone from the industrial sector. The reason for this was that although the municipal facilities are the ones that are exceeding their permit limits, we wanted to investigate what the industrial sector is allowed to discharge to the municipal facilities, and if it was too much for the water treatment plants to handle. We interviewed Brian Postale at Wyman Gordon. He is the principal environmental engineer and oversees around 30 facilities. We asked him a variety of questions mostly pertaining to the wastewater output of the Wyman Gordon facilities. Another important line of questions regarded contingency plans for accidents and past issues at the Grafton facility. Mr. Postale gave us a tour of the plant's onsite wastewater treatment plant to get a better understanding of the wastewater that leaves the plant and heads to the municipal facility.

After interviewing representatives from the MassDEP and the EPA, we decided that it would be beneficial to speak with a representative of the United States Geological Survey (USGS). This organization is responsible for the collection of raw data used for reports made by the MassDEP and the EPA. We met with Mr. Marc Zimmerman, a hydrologist who deals with water analysis in Massachusetts. We geared our questions towards finding out what his job entails and how the USGS interacts with the MassDEP

and EPA. Mr. Zimmerman pointed out that the USGS holds a large library of data from previous years on water quality in Massachusetts.

We interviewed George Harding, an enforcement officer for the EPA. All of our questions were extremely similar to those asked to the other EPA officials. Mr. Harding was the first enforcement official that we had met with so we focused our questions more on the enforcement aspect of the EPA operations. In addition to the questions asked to previous EPA officials, we also asked his opinion on the MassDEP's short-term remediation process.

We tried extensively to reach someone at the Fitchburg wastewater treatment facilities, but to no avail. We sent many emails, made personal phone calls, and left messages with several different people there but none returned our call. An interview with a representative from this plant would have been very valuable to this report; however, with no one speaking to us, it was an impossible task.

Publicly Accessible Reports

Triangulation is the application and combination of several research methodologies in the study of the same phenomenon (Triangulation in Research 2007). We used this technique to make sure that all of our information from our interviews can be considered accurate and to also make sure that there are no gaps in our research. We sifted through documents at the USGS pertaining to water quality in Massachusetts. We also obtained budget information from the state and federal government environmental branches to ascertain whether the budget has changed with inflation and cost of living increases. The third piece of the triangular puzzle was documents published by the organizations that the interviewees work for.

RESULTS AND DISCUSSION

As we collected our data, three main themes began to emerge. All three topics can be labeled as problems with the environmental protection system. Our research has shown that there are budgeting issues, personnel issues, and policy issues, all that need to be addressed in order to improve the institutions that are charged with protecting our environment.

Budget

Throughout the many interviews and the outside research conducted, one of the underlying themes was money. As always, it is difficult to discern between a lack of funds and a poor organization of the budget itself. In the case of the Clean Water State Revolving Fund (CWSRF), there is a clear decrease in the amount of money since fiscal year 2001. As seen in Figure 1 below, the amount of money allocated to the CWSRF has been reduced by \$662 million or nearly 50 percent.

The CWSRF provides low cost loans to the states and has been cited by the EPA as one of the most cost effective programs in government (EPA 2005). A cut in funding on a federal level means a financial commitment from the states. States would have to pay more money themselves for the same amount of work because of the decrease in funding from the federal government, which means they have less money available for other departments unless they are distributing more money to water treatment. Some states have used the little money they do receive with more efficiency and are also using creative ways to generate the remainder of the funds required. These stories are outlined on the EPA website in an annual award known as the Performance and Innovation in the SRF Creating Environmental Success (PISCES) award (EPA 2007).

| State Grants Summary Table (In millions of dollars) | | | | | |
|--|------------|------------|---------------------|---------------------|------------------------|
| | FY 2001 | FY 2006 | FY2007 President | FY2007 Committee | Committee v. FY2001 |
| Clean Water SFR | 1350 | 887 | 688 | 688 | -662 |
| LWCF “Stateside” | 90 | 28 | 0 | 0 | -90 |
| North Am. Wetlands Conservation | 40 | 39 | 42 | 37 | -3 |
| State Wildlife Grants | 75 | 67 | 75 | 50 | -25 |
| PILT | 215 | 232 | 198 | 228 | 13 |
| Landowner Incentives | 0 | 24 | 24 | 15 | 15 |
| Total | 1770 | 1277 | 1027 | 1018 | -752 (-42%) |

Figure 1: CWSRF Funding

Source: H.R. Rep. No 109-465, retrieved on February 12, 2007 from
http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=109_cong_reports&docid=f:hr465.109.pdf

Our interviews came to the same conclusion that there was not enough money being placed into the appropriate programs. This lack of financial support has led some programs to fail and others to not operate at the level of quality required. Damien Houlihan (Nov 2006), the EPA team leader for industrial permitting, mentioned that there is a large scale budgeting problem. He also said that it had been a long time since anyone had been hired and not for lack of need. He told us that the budget is too small to properly do anything about it and many people have either left through retirement or have quit. Marc Zimmerman (Nov 2006), a hydrologist for the USGS, also mentioned a cut in

the staffing at the MassDEP. A cut in funding in the CWSRF may mean that there is a cut in the funding given to organizations such as the MassDEP. Paul Hogan, a MassDEP official who deals mostly with National Pollutant Discharge Elimination System (NPDES) permits, said that there was a staffing problem within the is also a direct result of the lack of funding given to the department (Personal Communication Nov, 2006).

Another result of the declining funds in the CWSRF is the inability for states to afford massive restructuring of the facilities even if they require such changes. The town of Fitchburg, MA is one such site that has been deemed needing change. Their municipal wastewater treatment site is long overdue for an overhaul but it will be a multimillion-dollar project. The town also has a large quantity of combined sewer overflows (CSOs). A CSO is a pipe that was inserted into existing sewer systems to account for any possible overflows caused by the combined systems. The original established sewer systems were in place to carry storm water from drains. When running water and internal bathrooms became a staple of every house, the pipes carrying out sewage were tied into the storm water sewers to save money. Normally, the pipes can handle the combined capacity of water; however, in times of heavy rain the pipes cannot handle the water traffic so the CSOs were designed to carry this overflow safely to local bodies of water. This overflow can carry a large amount of coliform and fecal matter during extended period of time with rainfall. CSOs are a large problem as they are very common and the old pipe systems are extremely expensive and difficult to replace.

It is difficult to determine the cause of such a budget cut of the CWSRF without discussing the various political and governmental policy issues. Representative David Obey (D. WI) states in the House of Representatives Report 109-465 that “The overall

lack of funds to address national needs is the direct result of a Republican fiscal plan for 2007 that values tax cuts for the most well off over critical priorities like protecting the environment” indicating that it is a partisan issue (H.R. 109-465 2006).

Peoplepower

Tied in closely with the theme of budgeting issues affecting the efficiency of departments to protect the environment, is the theme of peoplepower. The subject of peoplepower raises two issues that can hinder the ability of governmental institutions to successfully execute its purposes, lack of employees, and a difference in philosophy or attitude that can lead to communication gaps between, or even within, organizations.

The majority of data collected surrounding the topic of peoplepower is firsthand accounts from the people that see the results of that problem everyday. All of the people that we spoke with about peoplepower informed us that there was a clear issue with a lack of it. Mr. Damien Houlihan from the EPA stated that the EPA has not hired anyone in a very long time and not for lack of need. He discussed with us the fact that people have been leaving the EPA through either retirement or other reasons, and “there has been no one hired to take their places” (Personal Communication Nov, 2006). The reason given for this anomaly was the lack of budget, tying back to the earlier discussed theme of lack of funds.

Mr. Houlihan was not the only one that mentioned a problem with lack of workers. Mr. Paul Hogan from the MassDEP also mentioned that there was “absolutely a manpower problem” (Personal communication Nov, 2007). He went on to say that due to a lack of peoplepower, the workers that the MassDEP and EPA have are focused on high risk and high volume generators. High volume generators are also known as large

quantity generators (LQG). Because the MassDEP has such a limited number of inspectors, small quantity generators (SQG) can go for very long periods of time without an inspection.

Worcester Polytechnic Institute (WPI) is an SQG when it comes to wastewater due to the small amounts of toxic chemicals that are used and discharged. We spoke to WPI's health and safety officer Mr. Dave Messier. Mr. Messier informed us that it had been over ten years since the school had received an inspection from the MassDEP. This did not mean that WPI does not communicate at all with the MassDEP, as it must file yearly reports detailing the methods of wastewater management. Although SQGs do have to submit annual reports, the fact that they do not get inspected regularly, if at all, can open the door for small leaks or faulty equipment to go unnoticed by government officials, a point that was brought up by Mr. Brian Postale, safety officer for Wyman Gordon.

Mr. Postale is in charge of safety at Wyman Gordon, which is classified as a LQG due to its use of large amounts of hydrofluoric acid in their etching process. Due to their LQG status, Wyman Gordon must undergo yearly facilities inspections. Mr. Postale agreed with everyone else we had spoken with as to there being a definite problem with lack of peoplepower, and went even further to say that the peoplepower that was available was being misused to inspect companies like Wyman Gordon yearly, when these yearly inspections always cleared with the MassDEP, and places like WPI, and other SQGs do not get inspected at all. The necessity of yearly inspections on LQGs is not a focus of this paper so that opinion of Mr. Postale's will not be explored or discussed

further; however, it is important to note in the context of this project that that opinion is held of the MassDEP due to its lack of employees.

To see how the problem of peoplepower has evolved over the years it is important to investigate the LSP profession and its role in safeguarding the environment. To learn all we could about this we spoke with Mr. Joel Loitherstein. Mr. Loitherstein is not only an LSP, but he helped to design the position. We learned that the entire LSP profession was created due to the MassDEP having a huge peoplepower problem in the 1980s. This problem caused a huge backlog of accident sites that could not be cleaned up because of the lack of employees to sign off on steps in the remediation process. The LSPs were created in 1990 to be able to handle accident sites and sign off on certain stages of the clean up process without the MassDEP having to oversee all of the decisions made. This allowed the MassDEP to focus on inspections, permits, enforcement, and many other stages of saving the environment without having to worry about accidents, thus fixing the peoplepower problem at the time. All the while, the number of accident sites that were being processed increased.

In the many years that have passed since the birth of the LSP profession, the number of sites that have been closed has risen dramatically as seen in Figure 2. This figure shows the number of sites rise as the LSP profession became proficient in the 1990s.

Even though the LSPs helped relieve some of the duties of the MassDEP, making the workload smaller and the need for more workers more manageable, since that time the peoplepower issue has once again shown itself to be a problem. Many people in different sectors and departments have acknowledged the lack of peoplepower and how it

is a problem. There is another problem involving the people who work for all aspects of the environmentally concerned organizations, and this is an attitude problem.

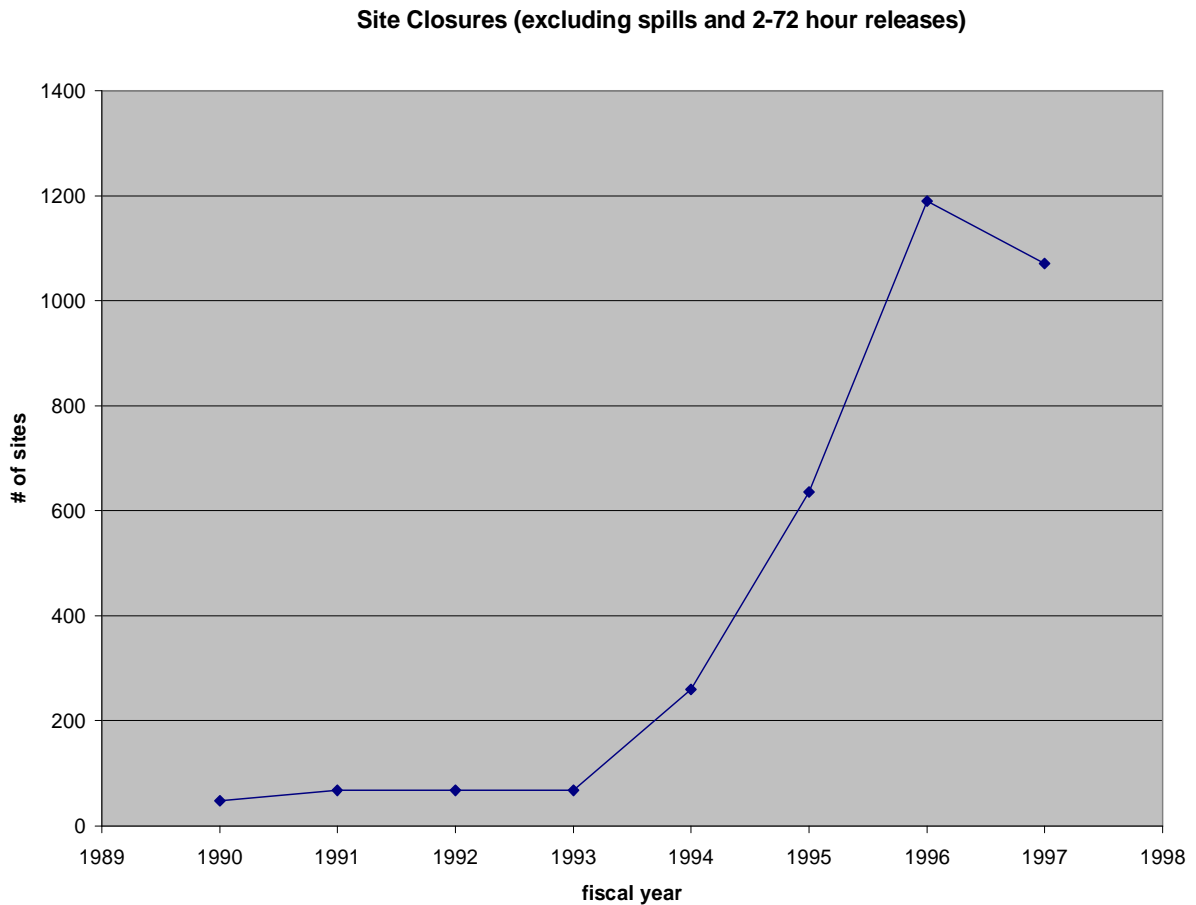


Figure 2: Site closures over time

Source: MassDEP and BHWSCP. (June 1998). *21E Program Evaluation Draft Generic Environmental Impact Report*. Retrieved September 17, 2006, from <http://mass.gov/dep/cleanup/priorities/geir.pdf>

The issue of attitude was first brought to our attention by Mr. Loitherstein. Mr. Loitherstein stated that many LSPs feel like they are scapegoats for the MassDEP. He also mentioned that the LSP profession was an unpopular one due to that. To investigate whether the MassDEP did have a negative attitude as suggested we examined a MassDEP internal report done in 1998 (MassDEP and BHWSCP 1998). This report outlined how

effective the MassDEP thought the private sector, namely the LSPs, were in helping increase the quality of the environment. One particular table in the document outlines the opinion of several classes of people felt about the LSPs. The MassDEP gathered focus groups of undisclosed numbers with representatives from the demographics in the table. That table can be seen below, Figure 3.

| | Reasonable | Too conservative | Careless | Unsure |
|---------------|-------------------|-------------------------|-----------------|---------------|
| DEP Staff | 46% | 2% | 47% | 5% |
| LSPs | 76% | 11% | 4% | 9% |
| Consultants | 68% | 11% | 3% | 18% |
| Citizens | 41% | 15% | 35% | 8% |
| Health Agents | 80% | 4% | 10% | 6% |
| Lenders | 87% | 6% | 0% | 7% |

Figure 3: How would you describe the standard of care exercised by LSPs?
 Source: MassDEP and BHWSCP. (June 1998). *21E Program Evaluation Draft Generic Environmental Impact Report*. Retrieved September 17, 2006, from <http://mass.gov/dep/cleanup/priorities/geir.pdf>

The numbers support the claims of turbulence in the MassDEP and LSP relationship, namely that 47% of MassDEP staff feels the LSPs are careless. Health agents, who are the ones that determine healthy environments feel that the LSPs are doing a good job, as evident by the 80% who judge the LSPs as reasonable, the highest ranking that was available.

These negative feelings between the LSPs and MassDEP have escalated already existing problems in communication. Mr. Loitherstein informed us that most LSPs find the Massachusetts Contingency Plan (MCP) very vague and open to interpretation. Because this document is the guide for how LSPs should handle spill sites, LSPs are forced to make many judgment calls on scene. This results in the MassDEP second guessing many LSP decisions, not only wasting peoplepower in an already proven to be

depleted core of workers, but also making LSPs uncomfortable to make judgment calls, thus causing them to be looking over their own shoulders instead of trying to remediate problems, lowering their efficiency.

Government Legislation

As previously discussed in this paper, we have established the issue of CSOs. The Clean Water Act (CWA) addresses this issue specifically in Section 221, which was written initially to grant funds through fiscal year 2003. On January 18th 2007, a bill was introduced to the U.S. House of Representatives to amend this document in Section 221. Predominately the amendments replace ‘2003’ with ‘2010’ and reallocate the funds through each fiscal year.⁵

The funds allocated for the above-mentioned bill come into play whenever the government has at least \$1.35 billion allocated for the CWSRF. Immediately after this aforementioned bill was brought before the House, Mr. Benjamin Grumbles of the EPA testified before the Subcommittee on Water Resources and Environment Committee on Transportation and Infrastructure at the U. S. House of Representatives. In his testimony, on January 19th 2007, Mr. Grumbles discussed and reinforced the necessity of the CWSRF. He established that the CWSRF is a large success and the Federal Governments monitoring of water infrastructure needs is conclusively working.

Throughout our research, it has been abundantly clear the problems associated with combined sewer systems; however, the questions are raised as to the importance in the federal eye. Row 1 of the table in Appendix C shows that since 2004 the amount of money allocated for the CWSRF has not been sufficient to allow section 221 of the CWA

⁵ Section 221 and the recent proposed amendments can be viewed in Appendix D and E, respectively. It should be noted that the amendments proposal, at the time of this documents writing, is still in legal motion through the House of Representatives.

to go into effect. Therefore, by these numbers, no federal grants have been issued towards sewer overflow control. If members of federal administrations such as Mr. Grumbles of the EPA put so much faith behind the CWSRF, why is it that the funding for one of the most pressing issues the CWSRF is designed to fund for, is not being focused on?

Related to Mr. Grumbles' testimony, in another testimony to the House Subcommittee on Water Resources and the Environment, on January 18th 2007, by Ms. Ellen Gilinsky of the Virginia Department of Environmental Quality and of the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA), the CWSRF necessity is reinforced. Ms. Gilinsky's testimony was a representation of Virginia's success since the inception of the CWSRF, and more importantly shown in this speech are the consequences of not funding the SRF.⁶ These consequences include but are not limited to economic impact, environmental impact, and a technological impact. Ms. Gilinsky powerfully presented that the strategy Congress initially enacted, to preserve and improve water quality, will be severely undermined by the reduction or elimination of the CWSRF.

Collectively in our interviews, Mr. Brian Pitt of the EPA, Mr. Damien Houlihan of the EPA, and Mr. Paul Hogan of the MassDEP, have all been in agreement over the costs to remediate municipal wastewater facility issues and specifically the costs needed to upgrade CSO systems. Confirmed by their predictions versus the steady downfall of the CWSRF monetary allocation, the consequences mentioned by Ms. Gilinsky can be justified.

⁶ The consequences can be reviewed in Appendix F.

RECOMMENDATIONS AND CONCLUSIONS

Through our research, we have discovered that there are many problems with the wastewater management systems in Massachusetts. One of the main goals of this project was to determine who was aware of the various problems in the state and to see what was being done to fix them. We learned that there is a clear amount of work that needs to be addressed but a dwindling budget and a lack of peoplepower. The various environmental institutions involved, the Massachusetts Department of Environmental Protection (MassDEP) and the Environmental Protection Agency (EPA), are aware of the infrastructure required to make these changes but are unable to with their budget and peoplepower situations. We have also determined that although no one was specifically knowledgeable of the United States Public Interest Research Group (USPIRG) report “Troubled Waters”, everyone knew of the overriding problem that the report describes.

One of the issues with the municipal facilities is their aging piping systems. The problem that these pipes can cause sewer overflow through an outdated piece of piping known as a combined sewer overflow (CSO), which has already been discussed in detail. There is simply not enough money or resources in general to repair these pipes in an adequate amount of time. We suggest that a research project be conducted to further explore the issues related to CSO systems and the policy implications.

Another interesting area of research that we suggest for future students revolves around the LSP profession. As discussed earlier the LSPs feel that they are scapegoats for the MassDEP. Due to the vagueness of the Massachusetts Contingency Plan (MCP), the LSPs are constantly second guessed leading to hesitation when necessary judgment

calls arise. This breakdown in communication has caused people to walk away from their jobs as LSPs, and has made the profession in general a very unpopular one. We feel that an entire project can and should be done to investigate these lapses in communications and to suggest methods of improvement.

APPENDIX A: INTERVIEWS

The group conducted many interviews to better understand the personnel interactions between various organizations and levels of government. We also wanted to see who was informed of the fact that Worcester County is ranked second concerning Clean Water Act permit exceedances according to a United States Public Interest Research Group (USPIRG) report entitled “Troubled Waters”. We tried to reach every group involved in the wastewater treatment process but were unable to contact certain officials. We first met with Mr. Dave Messier from Worcester Polytechnic Institute (WPI) because he works at the University to ensure that hazardous material is being safely taken care of before being dumped into the public sewer system. This level of involvement would represent a small quantity generator (SQG) as places like WPI do not produce enough hazardous waste for it to be considered a real risk. We also met with Mr. Brian Postale from Wyman Gordon to see the difference in the way that organizations such as the MassDEP treat large quantity generators (LQG).

From these interviews, we determined that we needed to speak with officials from the main organizations dealing with environmental protection in the state. First, we spoke with Mr. Paul Hogan from the Massachusetts Department of Environmental Protection (MassDEP) to gain his perspective on the wastewater situation in Massachusetts and Worcester County specifically. We asked questions about the way in which the SQGs and LQGs are treated in comparison and learned valuable information about the state of finances in the MassDEP. We also asked him about the USPIRG report and any reasoning behind the findings. We took this information and spoke with Mr. Damien Houlihan, Mr. Brian Pitt, and Mr. Dave Pincumbe, all from the Environmental Protection

Agency (EPA), who explained a likely reason for the standing in the USPIRG report. We also gained a better understanding of financial situation at the EPA. We then decided to meet with State Senator Karen Spilka to determine the relationship between the MassDEP and the EPA and the state government.

In order to complete the chain of command, we needed to speak with someone who writes the reports and someone who collects the data. We spoke with Mr. Joel Loitherstein, a licensed site professional (LSP), in order to see how the data on-site is collected and how the decisions are made regarding the cleanup of hazardous sites. We also wanted to determine his relationship as a member of the private sector with the government officials from the MassDEP and the EPA. After speaking with Mr. Loitherstein, we talked with Mr. Marc Zimmerman from the United States Geological Survey (USGS) to see where the MassDEP and the EPA get their empirical evidence for the status of sites so they can gauge progress on the cleanup. Mr. Zimmerman was also helpful to explain the relationship his organization has with the MassDEP and the EPA.

Mr. Joel Loitherstein, licensed site professional:

This interview was conducted on December 3, 2006 by Kevin Gagnon. Ryan Keough took the minutes. Prior to this interview, we submitted the questions to Mr. Loitherstein, as we did with all of our interviewees. Mr. Loitherstein came to the interview with his answers already typed out under each question that it refers to. The entire transcript of what he typed is below.

1. What was the motivation to start the LSP program?
 - i. Move low priority sites through the system without DEP involvement. At the time there were several thousand sites backlogged. In addition, DEP had to sign every bill of lading before soil could be moved. Therefore, numerous soil piles at gas stations.
 - b. What was done to remediate spills prior to this?
 - i. DEP involved in every site
2. What does one need to do to become a certified LSP?
 - i. Technical degree (even astronomy as long as they learn the scientific method) 8 years experience, 3 years in responsible charge of hazardous waste sites
 - b. Test?
 - i. 150 questions, passing grade developed each time test is given
 - ii. Needs to pass whole thing, if one part of the test is failed, so long as a passing grade is achieved overall, LSP certification still granted.

3. In the event of an accident, what is the protocol to get an LSP? Who contacts who?
 - i. MCP outlines all reporting guidelines
 - ii. 120 day
 1. Potentially responsible party (PRP) or Responsible Party (RP) found out through their LSP that a reportable concentration exceeded
 - iii. 72 hour/2 hour
 1. more serious- could have been a sudden release so they probably contact an LSP. Find LSP through word of mouth or from LSP board. Unless an imminent hazard, the reporting obligation is strictly with the RP
 - iv. 1 exception → in case of “eminent hazard” (as dictated by the MCP) LSP is responsible to report.
4. Who funds the LSP?
 - i. Typically the PRP or the RP. However, if condition found as a result of a real estate transaction, the LSP is funded by the purchaser, especially if the RP is land poor, then costs are deducted from sale price.
5. What are your day to day interactions with...
 - a. DEP?
 - i. Usually talk to somebody at the DEP once or twice a week.
 - b. EPA?

- i. Rarely. EPA has declared MA a delegated state in that we have such a good program that the EPA allows dealing with all but the nastiest sites.
 - ii. One exception: the discharging into storm water requires permit from EPA
- 6. Do most LSPs do the job as a profession or do they have another job and perform LSP duties as needed?
 - i. Most do it as a profession. There are so many things you have to know that it takes up most of your time. Some do related expert witness work.
- 7. What is the typical duration of a cleanup?
 - i. 6 months to several years
- 8. What is the most expensive project you have worked on to date?
 - i. Around 750,000
- 9. Are there different qualifications for where an LSP is going to work?
 - i. No. This was discussed and it was decided that we should try it out as a single qualification/ profession and see if through natural evolution, additional qualifications became necessary. As with engineering – civil engineering was only a differentiation from military engineers. Then there were mechanical, chemical, environmental, etc. as the professions became more specialized.
- 10. Are there different classes of LSPs?
 - i. No, LSPs only sign reports that they feel qualified to do so.

11. What do you know about Worcester County's status on Clean Water Act Permit violations?

i. I don't

12. Do you think enough is being done in MA to ensure the same cleanup of accidents?

a. Funding?

i. **Staff?**

ii. **Equipment?** Yes, the state has hired several firms in different areas of the state to perform emergency response actions. DEP personnel are always on call to respond to these sudden releases. If an LSP is not involved, DEP will tell them how to find one or possibly recommend one. There are some remedial firms that have them in-house or have close alliances with an LSP and will call them in.

b. Communication?

i. Communication is good

c. Punishment?

i. Punishment is too easily doled out and too draconian. Many LSPs have been second guessed by DEP and DEP decides they did something wrong. Then a complaint is filed with the LSP board. The board is made up of five LSPs and six non-LSPs. The lay people are not in the best position to judge LSPs and rely heavily on the LSPs, some of whom have very limited experience. The

tendency of the board is to mete out very harsh punishment and it is a process that can take several years to resolve.

- d. If there is a problem, what do you think needs to be done?
 - i. There needs to be an attitudinal change. LSPs are constantly in fear of losing their license. Engineers, psychologists, lawyers, etc. have a much lower percentage of professionals that have received discipline, let alone have lost their license. 5 to 10 percent of LSPs have lost their license. I think the problem is at the top. The Commissioner of DEP and the Exec Director of LSP board feel its part of their job description to punish LSPs.

13. We have noticed in our research that the EPA has been cutting back costs in places like shutting down their libraries. Is there any evidence of these cutbacks that you see when it comes to remediation?

- i. Most of the work I do involves DEP and their resources and libraries, so I'm not aware of any

Aside from the above questions that, as mentioned earlier, Mr. Loitherstein provided us with the answers to prior to our actually beginning the interview, we also discussed other issues related to the LSP profession. We asked Mr. Loitherstein what the process was to continue being an LSP. We were wondering if there was a license renewal process or what the qualifications were to remain certified. We were informed that there is a continuing education program in place requiring the LSPs to continue taking classes to remain certified.

We also asked Mr. Loitherstein what kind of help there was for LSPs out in the field. He told us about the Massachusetts Contingency Plan (MCP) hotline. This relatively new entity was a phone number that LSPs could call when they were having a hard time trying to put the vague MCP to use in the real world, which according to Mr. Loitherstein, happens quite often. Mr. Loitherstein told us that too often the LSP on site at a chemical spill is forced to make a judgment call on what action should be taken due to the nature of the MCP. He felt that before the hotline was put in place the LSP had absolutely no council with any MassDEP officials when making the decisions. This lack of communication caused the MassDEP to use the LSPs as scapegoats when something went wrong, making the LSPs feel as if the MassDEP was against them rather than on their side to save the ecosystem.

Mr. Loitherstein continued his point by saying MassDEP too often had their priorities confused and instead of helping the LSPs to get the job done being their first priority, they instead focused on enforcing the rules and doling out punishment for bad decisions in the field. This harsh criticism makes the LSP profession a very unpopular job. Mr. Loitherstein (Dec 2006) went so far as to say that “most LSPs would make a living any other way if they could” due to the MassDEP’s unreasonable enforcement actions.

Karen Spilka, Massachusetts State Senator

This interview was conducted on December 3, 2006 by Ryan Keough. Kevin Gagnon took the minutes. The following is a summary of what was learned at that interview.

What is the job description of a state senator?

The state senator's job includes everything that is necessary to make their district run, everything from pushing legislation through the state senate to taking phone calls from concerned citizens and dealing with potholes and streetlights. It is the job of the state senator to be the liaison between the people and the government. In regards to the MassDEP, the state senators can pass legislation that affects that branch of the government, from budget to personnel. They also have committees that sit and determine if the MassDEP is working up to state standards and whether or not they are using the allotted budget efficiently.

We also learned that the head of the MassDEP changes with a change in governor. Since the governor has indeed changed during the writing of this project, many things may be changing as we write this.

Mr. Dave Messier, Environmental and Occupational Safety Manager

This interview was conducted on November 20, 2006 by Ryan Keough. Marshall McGoff took the minutes. Prior to the meeting, we emailed the questions to Mr. Messier as we did with all of our interviews. The following is a series of questions and answers that were asked during the interview as well as those not specifically presented beforehand:

What is your position at WPI and what does it entail?

Mr. Messier answered that he is the Environmental and Occupational Safety Manager for WPI and is responsible for keeping the campus up to code concerning the new regulations passed by the government. We then asked him how he keeps in touch with the new legislature. He mentioned several avenues of information such as the campus consortium for environmental excellence and told us the website where more

information could be located was www.c2e2.org. He also said there was a newsletter called “Compliance Quarterly”, a safety bulletin, and a nationwide campus safety website www.cshema.org where he obtained all the information needed to stay informed. Mr. Messier cited a recent change in policy with the EPA shipping manifests and told us that he had been informed well in advance of the change because of his sources of information and was able to make the appropriate changes.

What are your day-to-day interactions with the MassDEP and EPA?

Mr. Messier explained that there are no day-to-day interactions with the MassDEP or the EPA. He went on to say that, the university has not been inspected by the MassDEP in recent history and there are no scheduled visits. He said there was an incident with an underground oil tank that had leaked on 49 Institute Rd but it was reported immediately. There had been soil contamination and an LSP was contacted for their expertise. The LSP helped the university install 5 monitoring wells 12-15 feet deep to ensure that the contamination was not moving. The final report of this accident was submitted in the summer of 2006.

What is the protocol for WPI to obtain a permit to work with chemicals in a lab?

Mr. Messier said that WPI paid an annual fee between \$500 and \$1000 to the state to be allowed to store hazardous wastes. He enlightened us to the fact that WPI is considered a SQG and can only store hazardous waste on site for 180 days. When asked what was done with the waste after this period of time, he was very quick to respond and quite knowledgeable on the locations of the wastes disposed by the university. Mr. Messier informed us that a company called “Triumvirate Environmental” collects the

wastes and transports them to a facility designed to deal with it. He mentioned that the waste solvents were incinerated, the oil was recycled and the mercury was land filled.

We also asked Mr. Messier about the permits for the new laboratory building “Gateway Park” and how they differed from renewing a permit for the current facilities. He elaborated that WPI had submitted the required paperwork and April 1st was the target date for the site to be finished.

What is the process in the event of an accidental spill in a lab?

Mr. Messier pointed us to the WPI hazardous waste management plan, which was from the environmental and occupational safety. He said there was a contingency plan in effect that the staff was supposed to be familiar with. Along with this question, we also asked Mr. Messier was done to ensure that the wastewater leaving the laboratories was not contaminated. During our first meeting, he simply explained that there was an acid-base / pH filtering system that would adjust the pH to the required levels for the county. We asked what would happen if there was something wrong with the machinery and he explained during our tour of the facility that another company was responsible for such emergencies but he would be contacted by the WPI Police as well. The entire treatment facility is located underneath Goddard Hall on the WPI campus.

When asked if this processing was enough to purify the wastewater Mr. Messier explained that for a SQG such as WPI it was as much as they could afford. The university does not budget enough money to treat the wastewater as much as a larger facility would have to. He also explained that remediation of the wastewater would only be necessary if students or faculty were not following proper lab procedures for disposal of hazardous wastes or solvents.

Mr. Paul Hogan, MassDEP official

This interview was conducted on December 4, 2006 by Kevin Gagnon. The minutes were taken by Marshall McGoff. The questions asked to Mr. Hogan were sent previously as they were with all of the interviews. The following is a series of questions and answers that were asked during the interview as well as those not specifically presented beforehand.

What is your job and what does it entail?

Mr. Hogan responded that his deals with the permitting conditions and not with compliance. He works with NPDES permits and issues them jointly with the EPA region 1. Mr. Hogan also went on to say that, there is no primacy in the state of Massachusetts about those permits and therefore both the EPA and the MassDEP have to sign off on them. He explained the basic structure of the MassDEP in that there are distinctly different bureaus for the environmental divisions. He referred to them as resource protection, waste side cleanup, and waste prevention. He also said that there were four regional offices, the main office being in Boston, MA, with around 1000 employees in total.

According to a recently released USPIRG report, Worcester County is the second worst county in the nation concerning major facilities exceeding their clean water act permits. Is there any reason for this poor ranking?

Mr. Hogan was very careful to answer this question as we had not previously sent the report to him. We explained the basic details of the report to him and tried to convey as much information as we could. He understood the problems addressed in the report and was very quick to respond about an individual case in Fitchburg, MA. He explained

that the town of Fitchburg had two different municipal wastewater treatment plants and that each had been designed for a different purpose. The westerly plant was mainly used for the treatment of papermaking wastes in years past but the industries have left the area and the plant is not operating at the maximum capacity at all. The easterly plant was mainly used for commercial and industrial wastes and continues to operate at a much higher capacity than it should be for the age. Mr. Hogan explained that the plant is 30 years old and the aging infrastructure desperately needs an upgrade. He also mentioned that there was a problem with the sewer systems in that they were a combined system, which means that if they overflow the untreated waste will flow into the river.

What is being done to remedy this problem?

Mr. Hogan first answered that the Fitchburg site has been notified that they are in violation and they are in the process of upgrading their sewer systems. He also said that the town will be upgrading their treatment plant as well. The process is long and expensive and it will be some time before any change is noticed. Mr. Hogan commented that the transition will take 5-10 years and will cost \$50 to \$100 million. He said the main reason it will take so long to build is the restructuring of the way in which towns receive aid from the Clean Water State Revolving Fund (CWSRF). The money used to be in the form of grants but was changed to low interest loans.

What does it take to get a permit to work with hazardous wastes in Massachusetts?

Mr. Hogan enlightened us to the fact that there are no required permits to use and handle hazardous waste. He confirmed that there was only a required permit to store and dispose of the wastes. We also asked about contingency plans in regards to hazardous wastes and he mentioned that it was the responsibility of the fire marshal to handle such

things. He stated that there was education missing about the spill prevention, control and countermeasure (SPCC) program and EPA regulations in general.

What is the relationship between the MassDEP and the EPA?

Mr. Hogan explained that in many cases, the EPA was considered the primary organization and the MassDEP was the local representation. One example was the air quality in the state. He said that the MassDEP and the EPA met regularly and had quarterly meetings to discuss regional issues. He also stated that the EPA will sometimes check up on the inspections performed by the MassDEP to ensure the quality of the work done. Mr. Hogan informed us that the EPA funds the MassDEP mainly through Section 106 of the Clean Water Act (CWA).

Is there enough being done in Massachusetts concerning wastewater treatment and if not why?

Mr. Hogan told us that there was “absolutely a manpower problem” in the state regarding staffing at the MassDEP. He mentioned the issue of risk assessment in the mindset of the workers at the MassDEP. They are not interested in investigating facilities that have no history of accidents. He said that if there was no previous record of accidents they would not bother unless they knew there was a problem beforehand. The MassDEP was only going to be looking for worthwhile violations so they could get as much money from the fines as they could with the limited staff they had. He clarified that the MassDEP would consider only immediate dangers in regards to their size and location. He commented that it would be easier if industries made the push for self-policing much like dry cleaners are now.

Damien Houlihan, Industrial Permitting Team Leader for the EPA

This interview was conducted on December 5, 2006 by Kevin Gagnon. Ryan Keough took the minutes. Below is a summary of the interview.

What is the relationship between the EPA and the MassDEP?

Massachusetts is unique in that the MassDEP and EPA run on a non-delegated system. This means that the two entities work together in a partnership. They sign off on most things together. This is different from most states. In states such as Connecticut, the EPA acts as big brother to the MassDEP. This setup allows the EPA to actually issue permits though the MassDEP has to cosign them.

Because of this relationship, the MassDEP and EPA are in constant communications with each other. There are many things that the two groups do together. These include issuing permits, checking on the progress of permits, and certifying locations to be able to use chemicals.

We have seen the fiscal reports stating expectations the EPA has for the DEP, what happens if the DEP does not meet expectations?

Nothing really happens when the MassDEP does not meet the standards set forth by the EPA. Since the EPA determines the MassDEP's budget, they can withhold grant money, but it would have to be an extreme case of negligence to do that. Mr. Houlihan stated that he has never seen that severe an action taken against the MassDEP.

Do you feel that enough is being done in Mass. regarding wastewater remediation, accident prevention, and emergency response?

The best is being done with the resources that the EPA has to work with. However, there is a huge manpower issue in both the EPA and the MassDEP.

What is being done to remediate this problem?

There is not enough money in the budget to fix the problem, people are being let go or retire and there is not enough money to replace them. The budget keeps getting cut and the EPA and MassDEP is forced to try to make things more efficient, but they are really feeling the pinch.

According to a recently released USPIRG report, Worcester County is ranked as the second worst county in the nation with major facilities exceeding their Clean Water Act permit allowances. Is this a pressing issue?

Mr. Houlihan had never heard of the report, and had not even heard that the USPIRG did such a report. We explained the premise of the report and summarized the results of the report. He was surprised to hear that Worcester County had been ranked so poorly. When we discussed with him what compounds Worcester County had the biggest problems with, coliform and fecal matter, he took back his comment about being surprised and described for us the combined sewer overflow (CSO) equipment problem. The brunt of this issue we learned lies in the municipal facilities as they are the ones that are permitted by the EPA in regards to coliform and fecal matter, so he referred us to two of his colleagues, Brian Pitt, and Dave Pincumbe, that we spoke to that same day.

As a final note, we asked Mr. Houlihan how the EPA had responded to the at the time recent large-scale chemical spill in Danvers. He explained that the EPA responded as they do all major accidents with a team on the scene that day assessing the situation and taking samples from the area.

Brian Pitt, Municipal Team Leader, EPA

David Pincumbe, Water Quality Expert, EPA

This interview was conducted on December 5, 2006 by Kevin Gagnon. Ryan Keough took the minutes. After concluding the interview with Damien Houlihan, he excused himself to go find two of his colleagues that may have heard about the USPIRG report and could answer some more of our questions.

When we summarized the data for Mr. Pitt and Mr. Pincumbe, they were quick to address some points. One thing that they brought up right away was that it was possible that the numbers that were listed in the report were listed incorrectly, citing the incredibly large percentage of lead in the water as being a prime example, as lead at those levels in the water is fatal. They like Mr. Houlihan pointed to the problem of CSOs as huge problems in the area when it rained heavily. The Fitchburg water treatment facility we were informed has the largest scale problems in the state due to its very old and dilapidated infrastructure. Because of how bad the system in Fitchburg is, it was recently issued many permits and was recently ordered to overhaul their entire combined sewer system to alleviate the CSO problem.

Mr. Marc Zimmerman, a USGS official

This interview was conducted on December 7, 2006 by Kevin Gagnon. The minutes were taken by Marshall McGoff. Prior to the meeting, we emailed the questions to Mr. Zimmerman as we did with all of our interviews. The following is a series of questions and answers that were asked during the interview as well as those not specifically presented beforehand:

What is your position and what does it entail?

Mr. Zimmerman explained that his title is hydrologist and that he mainly monitors fresh water, which is considered lakes, streams, and surface water through specific projects. The USGS is responsible for filing reports requested by the MassDEP or the EPA. These organizations are the main supporters of the USGS through these types of projects as there is no item line budget from the state. He made it clear that his department strictly gives the facts and makes no interpretations of the data.

Mr. Zimmerman described a few projects that the USGS was currently involved with around the state. In Ipswich, MA, they are comparing the effects of having a green roof versus having a standard roof. He mentioned that the USGS rotates which river basin it monitors every 5 years, which is unlike Connecticut that rotates every year. Their work with the basins is related to designing options for water monitoring systems. He described the Assabet basin and that it had 4 wastewater treatment plants along it. He said that the majority of the flow in the summer is from these plants. The USGS monitors the total max daily load, which is the amount of waste the river can handle per day, and has a goal to reduce the amount of phosphorous by 2009. They check the nutrients, the phosphorous from sediments and aquatic plants as well as monitor the headwater through the wastewater plants to gauge the effectiveness.

What would you say is the average water quality in Massachusetts?

Mr. Zimmerman started first by saying that there is simply too much waste to handle. The wastewater treatment plants are too old and cannot handle the massive influx they are experiencing. He stated that there is not enough being regulated and mentioned pharmaceutical companies as a possible suspect. He also suggested that more testing be taken of samples. Still, he recalled that the Clean Water Act (CWA) was a tremendous

improvement and certainly brought more awareness. Mr. Zimmerman also said that people need to “bite the bullet and pay for what we have to live” concerning taxes for dams and bridges in the state.

How often are you in contact with employees from the MassDEP or EPA?

Mr. Zimmerman restated that the MassDEP and the EPA provide the USGS with funds through projects. He told us that meets with the MassDEP at the very least quarterly to hear presentations and learn about future projects. He stated that he meets with officials from the EPA monthly to discuss short reports on their progress for the month. When asked about the MassDEP’s attitude towards LSPs, Mr. Zimmerman said that there are interpretation problems and no secret agendas. He also reminded us that the USGS does not make recommendations and only provides the data.

Brian Postale, Environmental Project Manager, Wyman Gordon

This interview was conducted on December 8, 2006 by Kevin Gagnon and Marshall McGoff. Ryan Keough took the minutes. Aside from the interview, Mr. Postale also gave us a tour of the facilities used to treat the wastewater that they sent to the wastewater treatment facility. A summary of the interview and tour follows.

What is your position at Wyman Gordon and what does it entail?

Mr. Postale is the environmental project manager for all of Wyman Gordon. He is responsible for overseeing all of the large-scale projects for about 30 facilities worldwide. Each facility has an environmental project manager to oversee the day-to-day activities. Mr. Postale is only called in to handle large-scale projects. The projects can entail anything from accident cleanup to renovation of old wastewater treatment systems to newer more efficient models. He designed and oversaw the installation of all

of the wastewater treatment measures in the Grafton branch, which is where we interviewed him.

What are your interactions with the MassDEP and the EPA?

Mr. Postale expressed concern over a bias that he felt existed in the MassDEP. He stated that just because Wyman Gordon is an LQG, there was an unfair biased placed on them. He said that they receive inspections every year from the MassDEP and the inspections always go well, while places like WPI have not been inspected in years, simply because they are an SQG, despite the fact that they may not pass inspection. He noted the serious manpower issue at the MassDEP and understands that they do not have the staff to inspect everyone every year, but he felt that the MassDEP was not utilizing the people that they do have effectively.

Mr. Postale also said that Wyman Gordon maintains constant flowing communications with the MassDEP and EPA, which is a requirement of the funding that they receive.

Throughout our research, we came upon recent accident reports involving Wyman Gordon. What was done to clean up these accidents and what is being done to prevent them from reoccurring?

Mr. Postale was quick to say that the accident in question was a barrel of hydrochloric acid (HCl) that had a leaky cap. Less than a gallon was spilled and the contingency plan for such a spill was immediately put into effect and the site was remediated immediately.

On the subject of contingency plans, we asked Mr. Postale how the Wyman Gordon contingency plan is set up. He stated that the plan is different for every

compound that could possibly be spilled from their facilities. He assured us that they had one in line with the MCP guidelines.

We also learned from Mr. Postale that they are under permits from not only the MassDEP and EPA, but also to the town of Grafton, and the wastewater treatment plant to which they pump their wastewater. No permit can be less strict than any of the others, but one can ask for more strict guidelines. For instance, the water treatment facility would prefer that some fluoride be left in the wastewater, as they have to add it to the water during a step of the treatment process. However, the EPA has strict guidelines limiting the amount of fluoride in the water, so Wyman Gordon must follow the stricter code.

We concluded the interview with a tour of the facilities. Mr. Postale took us to see the onsite water treatment plant. It is in this plant that they remove fluoride from the wastewater. Wyman Gordon is a metal etching company and uses as its main etching solvent, hydrofluoric acid (HF). HF is a strong acid and needs to be removed from the water before being sent to the offsite treatment plant. To do this Wyman Gordon runs a simple co-precipitation reaction, in which HF is reacted with aluminum fluoride, and the fluoride precipitates out of solution. A polymer is then added, solidifying the fluoride. The fluoride then is dried into cakes, and the solid fluoride polymer is stored in large bins until it is collected and trucked off site.

George Harding, Enforcement Permitting Specialist, EPA

This interview was conducted by Kevin Gagnon on December 19, 2006. Ryan Keough took the minutes. For this interview, we began by asking Mr. Harding the same questions on how the EPA operates in conjunction with the MassDEP. He gave the same

answers as Mr. Houlihan did. This interview however, we sent Mr. Harding a copy of the USPIRG report with the questions we intended to ask him, so he could speak to it directly. The fact that we sent him the report prior to the interview made him the only person that we spoke that had seen the report. The following is a summary of the information we received from him that differed from Mr. Houlihan's responses.

When we asked him about the USPIRG report, he said the same thing that Mr. Pincumbe said earlier about data clearly being entered in incorrectly. We told him that the data was taken straight from EPA databases and he said that it was still a possibility that it was entered into their computers wrong. He also said that he did not see anywhere in the report that mentioned whether the facilities in question were under enforcement permits. He verified for us that all of the facilities were under long-term enforcement plans.

We asked him what the long term enforcement plans were. Long-term plans can be any length of time over a year, depending on the site in question. The MassDEP and EPA work with the Responsible party (RP) or potentially responsible party (PRP) to develop benchmarks that the facility has to meet over time. The EPA comes and checks on them with the MassDEP over time to make sure that they are meeting their deadlines. However, during the beginning phases of the permit, the facilities would still be breaking their original clean water act permit, making for the many consecutive weeks over permit levels. Mr. Harding also mentioned that a primary culprit of this was the Fitchburg treatment facility.

APPENDIX B: TOXIC SPILL REMEDIATION TECHNIQUES

Once an accident has occurred that leaks harmful organic contaminants into the environment, an on-site remediation process must begin in order to ensure the spread of pollution is minimized. In order to understand the regulations and standards the government sets for the cleanup of an accident site, one must first understand the way in which a site is cleaned.

When a site is deemed as contaminated, a few things need to be defined for each specific site. First of all, scientists need to determine the size of the plume. The plume is the area covered in contaminated material. The area of the plume is determined by the rate of diffusion of a chemical, the density of the soil being contaminated, and the time since the spill occurred. There are also experimental ways to determine the location of the plume. Along with the plume, the depth of the aquifer needs to be determined. The aquifer is a layer of earth at some depth where the terrain becomes very conducive to water absorption. This level is usually made up of silt or porous clay. An aquifer may also contain loose stone such as gravel. The aquifer is the main concern on most remediation sites because of its working water retention. Once the contaminants reach the aquifer it is possible for some of the more soluble ones to completely dissolve into solution, making them no less deadly, but far more difficult to remove.

Once the plume and aquifer have been determined, a plan of action can be decided upon. There are many different methods for removing harmful organic compounds from the area they have leached into. An effective remediation scheme may involve many of the known methods to ensure proper clean up. These methods range from simple methods, like restricting walls and funnel gate systems designed to guide

contaminated water away from important areas and into treatment stations, to some complex biological remediation techniques.

Vacuum Enhanced Recovery (VER)

The broad category of vacuum enhanced recovery systems is a very common type of remediation technique. This broad title describes any cleaning process where a pump is inserted underground into an aquifer to create a vacuum and take in the organic contaminants for treatment (Nyer 1985). These methods rely solely on the movement of water or air to remove harmful compounds.

Pump and treat method.

The most common and widespread used of all in-situ remediation methods is the pump and treat method. This protocol involves sending a water pump into the soil of a contaminated area and creates a vacuum underground, pumping the ground water through the soil, into the pump, and to the surface of the soil (Cherry and McKay 1989). The water is then chemically or biologically treated for whatever organic pollutants there happen to be (EPA 1997). The water is then re-released back into the environment and allowed to seep back into the soil. The biological or chemical processes used to destroy the contaminants from the working ground water are specific to present contaminants.

There are advantages and disadvantages to using the pump and treat method. The type of system needed to use for their remediation problem is often dictated by the geology of the infected area (Nyer 1998). The pump and treat system works best in an area where the soil or rock in the aquifer to be cleaned is very loosely packed. The tighter the soil is packed, the more difficult it is for the groundwater is to travel to the pump, and the longer it takes to reach the treatment center. In one documented case

study, the predicted time it would have taken to clean up the area by the pump and treat method would have been twenty years (Nyer 1998). If the system is used in a lightly packed soil system; however, it is extremely effective, being proven to only leave behind organic contaminants that can be naturally broken down in nature.

Air carrier treatment method.

The second type of treatment that falls under the VER classification is the air carrier treatment system. In the pump and treat method, the groundwater is known as the carrier for the organic contamination because it is physically bringing the pollutants to the pump. In air carrier treatment, air is pressured through the soil towards an air pump and the pump sucks up the air, and the organic contaminants with it (Nyer 1985). The contaminants are then treated and the air used to carry them is re-released back into the environment.

As with the pump and treat method, the air carrier treatment system has advantages and disadvantages. This system can work very well in tightly packed soil, because air can get through the tight soil faster than water. In the above-mentioned case study that would have taken twenty years to remove the contaminants from the dirt, it was estimated that using the air carrier method it would have taken two years. The drawback to this system is that little or no water can be present in the soil, or else the vacuum created with air underground will be ruined. Because of this, anytime the air carrier system is implemented, the aquifer first has to be dewatered. Dewatering is accomplished by placing a cap over the area to ensure no rainwater or surface water leeches down into the area, and then a high-powered vacuum system is used to completely dry the soil to the depth that is needed.

Biological Remediation Through In-Situ Reactive Zones

Biological remediation is a category of remediation systems that involve breaking down the organic contaminants into harmless byproducts or things that are easier to remove from soil using biochemical reactions (Nyer 1985).

The technique of in-situ reactive zones hinges on intercepting the contaminants rather than trying to guide them. In-situ reactive zones create conditions underground where chemicals can be inserted to take care of harmful organics. Two key words are used to distinguish the goal of the reaction to be carried out. A pollutant is either transformed or immobilized. A transformation mechanism takes the harmful compound and changes it into something that is not harmful to the environment. Immobilization can be characterized by changing a harmful contaminant to a compound that is much less water soluble, thus making it easier to remove from the soil (Nyer 1998).

The actual method of biological remediation is specific to exactly what kinds of contaminants are found in a particular aquifer. There are many advantages to using a bioremediation system over a VER system. The equipment used in bioremediation is generally quite a bit cheaper and smaller than used in VER. The smaller size means that normal site operations at a given company can continue with very little spatial hindrance. Another environmental advantage to this method is that most of the chemical reactions carried out in bioremediation help the environment naturally break down the pollutants so that the byproducts are often helpful to the surrounding area.

There are also disadvantages to this technique. Because this remediation method relies on the chemical spilled, customized processes need to be designed for every spill.

Air Sparging

Air sparging is a unique method that uses air as a contaminant carrier to remove harmful toxins from soil. A high-pressured stream of air is sent down into the soil, infiltrating the aquifer and stripping the contaminants from the soil and water particles. The stripping process makes the organic toxins undergo a phase change in which they are moved from liquid or solid to the vapor state. Once in the vapor state the contaminants are taken out of the soil in the same way that the forced oxygen leaves the soil, and is carried off harmlessly through the air. In the case that these chemicals are also harmful if inhaled, the air coming out of the ground must be purified.

Though the method described above seems like an incredible breakthrough in contamination removing, especially considering the speed at which the process can be carried out, it has drawbacks. First, the soil density cannot be too high. If the soil is too tightly packed, then the air stream will not be able to penetrate to the desired depths. Another disadvantage is that the soil must be completely homogenous the entire way to the point of pollution. If the air stream is going through low-density silt and hits a layer of thick dense clay, the stream will react by starting to flow laterally rather than vertically as intended. This effect would spread the contaminants farther out instead of bringing them to the surface. The ability to use this method of site remediation also revolves around the ability of the pollutant to be stripped from the soil and water. Every organic is ranked on a scale based on their ability to be stripped out of soil and water. If the rating is too high then the compound cannot be stripped from the ground in this method.

Phytoremediation

Phytoremediation is a remediation process by which the natural properties of plants and trees are utilized to remove organic toxins from sites. In nature, trees and plants use their root systems to take nutrients out of the soil and use them for metabolic function and life processes. There are many different forms of phytoremediation that are specific to the types of plants used and what kind of contaminant needs to be removed.

Essential and non-essential material uptake.

Compounds, such as nitrates and ammonia, are considered to be water contaminants and hazardous to the health of human beings. To plants; however, these molecules are essential to survival (Nyer 1998). If a spill of nitrates were to occur in a given area, the planting of different types of plant life in that area would ensure that these toxins would not only be cleaned up, but would also contribute to the environment.

Aside from substances needed for survival, some plants are known to absorb material not at all essential to any of their life functions. Different species of plants are able to take in different unimportant contaminants. The key to all uptake procedures in plants is to make sure that the root system for whichever organism is being used makes contact with the aquifer; otherwise, they will not be able to absorb contaminants.

Bacterial Incubation in Root Systems

It has been discovered that the root systems of certain plants act as great incubators for a variety of bacteria (Nyer 1998). With this knowledge, it is possible to grow bacteria that can digest organic pathogens in a root system of a tree, protected from the toxins of the contaminants until the cells are fully-grown. More important than simply being used as a good place to grow pathogen-eating bacteria, plant roots provide a perfect environment for most bacterial digestion reactions to occur.

Water pumping.

The structure of a tree trunk dictates its function as the plant's water pump, assuring the entirety of the tree has plenty of water to carry out life functions. This similarity to a water pump can be used to give a natural alternative to the pump and treat method of remediation discussed previously. Some trees such as the weeping willow have been measured to use and lose over 5000 gallons of water in a summer day. This is a much higher volume than simply using the pump and treat method alone. With this large water pumping ability, contaminated water can be absorbed out of the aquifer along with any soluble organic toxins.

Adsorption

The concept of adsorption is a simple one. A substance is designed with the properties necessary to adsorb organic contaminants out of the ground water (Nyer 1998). The substance is then simply removed, along with all the harmful toxins. The material used to adsorb the contaminants is very compound specific and many different materials can be used. Many organics can be adsorbed through activated carbon due to its high surface area and ability to form bonds easily. In addition, clays can be treated to retain any given organic material through chemical alterations. In recent years, many new biosorbents have been developed including chemically treating certain tree barks to adsorb specific organic materials.

APPENDIX C: FY 2007 PROPOSED FEDERAL APPROPRIATION (\$ MILLIONS)
January 31, 2007

| | <u>FY 2004 Funding</u> | <u>FY2005 Funding</u> | <u>FY 2006 Funding</u> | <u>FY2007 President's Budget</u> | <u>House/Senate Joint Resolution 20</u> |
|---|----------------------------|---------------------------|----------------------------|--|---|
| I. Infrastructure | | | | | |
| Title VI CWSRF | 1,350.00 | 1,100.00 | 887.00 | 687.60 | 1,083.82 |
| Drinking Water SRF | 850.00 | 850.00 | 837.00 | 841.50 | 841.50 |
| Grant Projects | 428.1 | 408.93 | 281.00 | 40.70 | -0- |
| Brownfields Loans/Grants | 93.50 | 89.00 | 88.70 | 89.10 | 89.10 |
| Clean School Buses | -0- | 7.00 | 6.90 | -0- | -0- |
| Clean Diesel Grants | -0- | -0- | -0- | 49.50 | 49.50 |
| | | | | | |
| II. Traditional Grants & Performance Partnerships: | <i>[1,175.2]</i> | <i>[1,145.76]</i> | <i>[1,113.08]</i> | <i>[1089.00]</i> | <i>[1089.00]</i> |
| • Water Quality | | | | | |
| * Section 106 | 200.40 | 210.00 | 216.17 | 221.70 | 221.70 |
| * Section 319 NPS | 238.50 | 209.00 | 204.28 | 194.00 | 194.00 |
| • 104(b) Coop. Agreements | 19.00 | 17.00 | -0- | -0- | -0- |
| • Wetlands | 15.00 | 15.00 | 15.77 | 16.80 | 16.80 |
| • Targeted Watersheds | 15.00 | 18.00 | 16.61 | 6.70 | 6.70 |
| • Coastal Beach Monitoring | 10.00 | 10.00 | 9.85 | 9.9 | 9.9 |
| • Wastewater Operator Training | | | | -0- | -0- |
| • Homeland Security | 5.00 | 5.00 | 4.83 | 5.00 | 5.00 |
| • UIC | 11.00 | 10.78 | 10.84 | 10.90 | 10.90 |
| • Air: State /Local Assistance | 228.50 | 225.00 | 220.26 | 185.20 | 185.20 |
| • Hazardous Waste/RCRA | 106.40 | 104.30 | 101.94 | 103.30 | 103.30 |
| • Brownfields | 50.00 | 50.00 | 49.26 | 49.50 | 49.50 |
| • Underground Tanks | 11.95 | 12.00 | 11.77 | 37.60 | 37.60 |
| • Indian General Assistance | 62.50 | 62.00 | 56.65 | 56.90 | 56.90 |
| • Information Exchange Network | 20.00 | 19.50 | 19.71 | 14.90 | 14.90 |
| | | | | | |

| | | | | | |
|--|----------|----------|----------|----------|----------|
| III. Superfund | 1,265.00 | 1,247.00 | 1231.00 | 1259.00 | 1259.00 |
| Underground Storage Tanks | 76.00 | 69.00 | 72.00 | 73.00 | 73.00 |
| IV. USEPA Internal Ops. (not covered above) | 3,173.60 | 3,152.77 | 3,166.68 | 3,186.31 | 3,186.31 |
| | | | | | |
| OTHER: | | | | | |
| USGS | 938.00 | 948.56 | 970.65 | 950.92 | 950.92 |
| * Water | 215.71 | 211.20 | 211.76 | 204.05 | 204.05 |
| USDA | | | | | |
| * EQIP | 967.57 | 950.00 | 1,017 | 1,000 | 1,000 |
| * CRP | 2,000.00 | 1,862.00 | 1987.00 | 2093.00 | 2093.00 |
| * CSP | 41.43 | 202.41 | 259.00 | 342.00 | 342.00 |
| * Wetlands Reserve Program | 298.97 | 267.00 | 250.00 | 403.00 | 403.00 |

Source: Harkins, William (Personal Communication, February 1, 2007)

APPENDIX D: SECTION 221 OF THE FEDERAL CLEAN WATER POLLUTION
CONTROL ACT

Section 221 of the Clean Water Act (CWA) shows the monetary allocations of the Clean Water State Revolving Fund towards Sewer Overflow Control. The issue of Sewer Overflow Control relates to the issue described in our report of Combined Sewer Systems. This appendix allows for the convenience of the reader to compare Section 221 of the CWA with the newly proposed amendments shown in Appendix E.

SEC. 221. SEWER OVERFLOW CONTROL GRANTS.

(a) **IN GENERAL.**—In any fiscal year in which the Administrator has available for obligation at least \$1,350,000,000 for the purposes of section 601—

(1) the Administrator may make grants to States for the purpose of providing grants to a municipality or municipal entity for planning, design, and construction of treatment works to intercept, transport, control, or treat municipal combined sewer overflows and sanitary sewer overflows; and

(2) subject to subsection (g), the Administrator may make a direct grant to a municipality or municipal entity for the purposes described in paragraph (1).

(b) **PRIORITIZATION.**—In selecting from among municipalities applying for grants under subsection (a), a State or the Administrator shall give priority to an applicant that—

(1) is a municipality that is a financially distressed community under subsection (c);

(2) has implemented or is complying with an implementation schedule for the nine minimum controls specified in the CSO control policy referred to in section 402(q)(1) and has begun implementing a long-term municipal combined sewer overflow control plan or a separate sanitary sewer overflow control plan;

(3) is requesting a grant for a project that is on a State's intended use plan pursuant to section 606(c); or

(4) is an Alaska Native Village.

(c) FINANCIALLY DISTRESSED COMMUNITY.—

(1) DEFINITION.—In subsection (b), the term “financially distressed community” means a community that meets affordability criteria established by the State in which the community is located, if such criteria are developed after public review and comment.

(2) CONSIDERATION OF IMPACT ON WATER AND SEWER RATES.—In determining if a community is a distressed community for the purposes of subsection (b), the State shall consider, among other factors, the extent to which the rate of growth of a community's tax base has been historically slow such that implementing a plan described in subsection (b)(2) would result in a significant increase in any water or sewer rate charged by the community's publicly owned wastewater treatment facility.

(3) INFORMATION TO ASSIST STATES.—The Administrator may publish information to assist States in establishing affordability criteria under paragraph

(1).

(d) COST-SHARING.—The Federal share of the cost of activities carried out using mounts from a grant made under subsection (a) shall be not less than 55 percent of the cost. The non-Federal share of the cost may include, in any amount, public and private funds and in-kind services, and may include, notwithstanding section 603(h), financial assistance, including loans, from a State water pollution control revolving fund.

(e) ADMINISTRATIVE REPORTING REQUIREMENTS.—If a project receives grant assistance under subsection (a) and loan assistance from a State water pollution control revolving fund and the loan assistance is for 15 percent or more of the cost of the project, the project may be administered in accordance with State water pollution control revolving fund administrative reporting requirements for the purposes of streamlining such requirements.

(f) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to carry out this section \$750,000,000 for each of fiscal years 2002 and 2003. Such sums shall remain available until expended.

(g) ALLOCATION OF FUNDS.—

(1) FISCAL YEAR 2002.—Subject to subsection (h), the Administrator shall use the amounts appropriated to carry out this section for fiscal year 2002 for making grants to municipalities and municipal entities under subsection (a)(2), in accordance with the criteria set forth in subsection (b).

(2) FISCAL YEAR 2003.—Subject to subsection (h), the Administrator shall use the amounts appropriated to carry out this section for fiscal year 2003 as follows:

(A) Not to exceed \$250,000,000 for making grants to municipalities and municipal entities under subsection (a)(2), in accordance with the criteria set forth in subsection (b).

(B) All remaining amounts for making grants to States under subsection (a)(1), in accordance with a formula to be established by the Administrator, after providing notice and an opportunity for public comment, that allocates to each State a proportional share of such amounts

based on the total needs of the State for municipal combined sewer overflow controls and sanitary sewer overflow controls identified in the most recent survey conducted pursuant to section 516(b)(1).

(h) ADMINISTRATIVE EXPENSES.—Of the amounts appropriated to carry out this section for each fiscal year—

(1) the Administrator may retain an amount not to exceed 1 percent for the reasonable and necessary costs of administering this section; and

(2) the Administrator, or a State, may retain an amount not to exceed 4 percent of any grant made to a municipality or municipal entity under subsection (a), for the reasonable and necessary costs of administering the grant.

(i) REPORTS.—Not later than December 31, 2003, and periodically thereafter, the Administrator shall transmit to Congress a report containing recommended funding levels for grants under this section. The recommended funding levels shall be sufficient to ensure the continued expeditious implementation of municipal combined sewer overflow and sanitary sewer overflow controls nationwide.

(33 U.S.C. 1301)

APPENDIX E: WATER QUALITY INVESTMENT ACT OF 2007

The following Amendment was proposed in January of 2007. It is important to note that during the time of this paper's writing, this amendment was in motion through the legislative system. The information presented in this amendment can be compared to that in Section 221 of the CWA in Appendix D.

SECTION 1. SHORT TITLE.

This Act may be cited as the 'Water Quality Investment Act of 2007'.

SEC. 2. SEWER OVERFLOW CONTROL GRANTS.

Administrative Requirements- Section 221(e) of the Federal Water Pollution Control Act (33 U.S.C. 1301(e)) is amended to read as follows:

(e) Administrative Requirements- A project that receives assistance under this section shall be carried out subject to the same requirements as a project that receives assistance from a State water pollution control revolving fund under title VI, except to the extent that the Governor of the State in which the project is located determines that a requirement of title VI is inconsistent with the purposes of this section.'

Authorization of Appropriations- The first sentence of section 221(f) of such Act (33 U.S.C. 1301(f)) is amended by striking 'this section \$750,000,000' and all that follows through the period at the end and inserting 'this section \$250,000,000 for fiscal year 2008, \$350,000,000 for fiscal year 2009, \$450,000,000 for fiscal year 2010, \$550,000,000 for fiscal year 2011, \$650,000,000 for fiscal year 2012, and \$750,000,000 for fiscal year 2013'.

Allocation of Funds- Section 221(g)(2) of such Act (33 U.S.C. 1301(g)) is amended to read as follows:

(g) Allocation of Funds- Subject to subsection (h), the Administrator shall use the amounts appropriated to carry out this section for fiscal year 2008 and each fiscal year thereafter for making grants to municipalities and municipal entities under subsection (a)(2), in accordance with the criteria set forth in subsection (b).'

Reports- The first sentence of section 221(i) of such Act (33 U.S.C. 1301(i)) is amended by striking '2003' and inserting '2010'.

APPENDIX F: TESTIMONY ON: REAUTHORIZATION OF THE CLEAN WATER STATE REVOLVING LOAN FUND

The following list of impacts is taken verbatim from Ms. Ellen Gilinsky's Testimony on January 18th, 2007.

Impacts of *Not* Funding the CWSRF:

The Committee has asked Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) to speak to the impacts of not funding the program in the future. There are many aspects to that.

- **The Clean Water Act Tool Box:** For each Federal dollar lost to the program, there is an even greater amount in State contributions and leveraged funds that will be lost. No other funding mechanism comes close to the CWSRF's buying power, in terms of meeting infrastructure needs. To that extent, the tool will be lost and is irreplaceable.
- **Solving Problems:** There will be diminished ability to address existing and future water quality problems because the fund is not large enough and would diminish over time.
- **Diminished Water Quality:** Water quality will be adversely affected. Good quality waters will deteriorate as needs cannot be met.
- **Impacts On The economy:** There will be diminished economic growth. The infrastructure will not be there to accommodate it and States have very limited ability to allow such growth in impaired waters.
- **Implementation:** Clean Water Act implementation will slow down.
- **Costs:** Infrastructure costs will increase as needs are met more slowly over time and subsidized interest rates are not available.

- **Small towns:** Smaller towns are of particular concern. Frequently, they have affordability problems and limited (or no) access to the bond market. States will be less able to provide technical assistance to get needed projects completed.
- **Compliance:** There will be increased non-compliance and more need to rely on enforcement and penalties to motivate action.
- **Collaborative Problem Solving:** There will be less watershed initiatives to collaboratively solve complex problems, because there will be not funding for the 604(b) set aside and there will be less CWSRF seed funding to get stakeholder buy in to implementing solutions.
- **Partnership:** Viewing such impacts in their entirety, the partnership between Federal, State and local governments, citizens and other stakeholders would be subject to great strain. Implementation of the Clean Water Act will be much more difficult. A weakened CWSRF undermines the carefully crafted strategy Congress enacted.

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