



Lehigh County Authority
Source Water Protection Plan
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Lehigh County Authority

Lehigh County, PA

PWSID #3390073

Source Water Protection Plan

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Glossary of Water Terms

Aquifer – a natural underground layer of sand, gravel, or rock that contains water.

Community Water System – a water system that supplies drinking water to 25+ people year-round in their residences.

Delineate – to mark the outline of a groundwater or surface water study area.

Emergency Action Plan – a preparedness plan developed by a water system to form consistent procedures in an emergency situation.

Geology – The study of the Earth, and the Earth’s materials and processes.

Groundwater – underground water that supplies wells and springs.

Point Source Pollution – pollutants that come from a single exit point, like a pipe.

Management Strategies – approaches taken by the water supplier and the steering committee to protect the sources of drinking water.

Non-point Source Pollution – pollutants that are contained in water runoff from construction, roads, agriculture, or residential areas.

PSOCs – **P**otential **S**ources **O**f **C**ontamination – areas or activities that may potentially have a negative impact on the drinking water source.

Public Water System – a water system that supplies water to 25+ people at least 60 days per year.

Source Water – the wells, springs, reservoirs, or lakes in their natural state, prior to treatment for drinking use.

Study Area – the land regions that may impact the drinking water source.

Surface Water – water sources that are open to the air, such as rivers, lakes, streams, and reservoirs.

Topography – graphic display of the Earth’s surface including the elevation, and position of natural and man-made features.

Watershed – the land area from which water eventually drains to a lake, river, or reservoir.

Wellhead Protection Area – the land area around a well or wellfield which is proactively managed to prevent contamination.

Zone I - Zone I is a circle around the well or spring with a radius between 100 and 400 feet, with the greatest potential for contamination.

Zone II - Zone II is the surface representation of the “capture zone”, the amount of water contributing to a well or spring in 10 years or less. The zone is usually measured in acres.

Zone III - Zone III, or the zone of contribution, is the portion of the watershed that can contribute water to the capture zone, usually measured in acres or miles.

Lehigh County Authority

Lehigh County, PA

Source Water Protection Plan

Executive Summary

Clean, safe drinking water is often taken for granted. Many people have no idea where their water comes from, how it is purified, or how it arrives at their sink. Protecting the raw water supply has been increasingly recognized as a critical element in the overall mission of delivering a safe and reliable supply of drinking water to consumers. Comprehensive source water protection not only benefits the water supply, but ultimately the economic, social, and environmental well-being of a community.

Project Background

In 2009, the Lehigh County Authority (LCA) applied for assistance from the Pennsylvania Department of Environmental Protection (DEP) Source Water Protection Technical Assistance Program (SWPTAP). In November 2009, DEP approved the work plan and initiated the LCA SWPTAP project.

The objective of this project is to develop a source water protection plan that delineates the recharge areas for the LCA – Central Lehigh Division groundwater wells, determines the transport times and pathways of potential contaminants, identifies potential sources of contamination, and complies with Pennsylvania Department of Environmental Protection’s (DEP) Chapter 109 regulations (see Section 1.3).

Description of Study Area

The study area for this project includes the City of Allentown, the townships of Weisenberg, Lowhill, Upper Macungie, Lower Macungie, Salisbury, and South Whitehall, and the boroughs of Alburtis and Macungie in Lehigh County, and Longswamp Township in Berks County. Much of the study area was primarily agricultural until a few decades ago. It has been gradually converted from rolling farmland to suburbs that support the urban core of Allentown and Bethlehem. Agriculture remains

significant in the western part of the study area, suburban development dominates many of the municipalities that border Allentown, and Allentown itself is a high-density urban center.

Overview of Water System

The focus of this plan will be LCA's Central Lehigh Division (CLD). The CLD delivers drinking water to eight municipalities, and the vast majority of LCA's customers. The remaining LCA customers are served by 11 small systems that supply between 9 and 1,000 customers.

The CLD obtains its water supply from 19 wells. Currently, the water system serves an average demand of 6.3 million gallons per day (mgd) and a maximum demand of 8.2 mgd. LCA provides water to a population of 42,000 through 15,089 residential, 557 commercial, and 6 industrial connections.

Source Water Protection Zone Delineations

A significant purpose of the source water protection program is to delineate protection zones around each well. Source water protection zones for the LCA water sources were delineated using a steady-state hydrogeologic computer model and other calculations based on well information, groundwater flow patterns and watershed configuration. The most protective zone, Zone I, is a circle around each well with a radius ranging from 100 to 400 feet (DEP, 2005). The second most protective zone, Zone II, represents the 10-year time of travel – the area from which groundwater has a high probability of reaching the well in fewer than ten years. Zone III is the upgradient extent of the subbasin that can contribute water to the capture zone. The Zone II area for the wells is present in South Whitehall, Upper Macungie, Weisenberg, Longswamp, Maxatawny, and Lower Macungie townships. The Zone III protection area is much more extensive, as it encompasses nearly 50,000 acres and includes multiple municipalities in Lehigh and Berks counties.

Potential Sources of Contamination (PSOCs)

After the protection zones were delineated, numerous sources were used to identify potential sources of contamination (PSOCs) in the zones. Both point sources and non-point sources were identified. All of the PSOCs were ranked from A to F, with A posing the greatest potential threat and F the least potential threat.

The most significant non-point sources of pollution include runoff from roads, agricultural lands, and residential development.

Publicly-available environmental databases, field surveys, and input from the steering committee and DEP were all used to identify point source PSOCs. A total of 284 point source PSOCs were identified for the water system. There is one PSOC in Zone I, 61 PSOCs in Zone II, and 222 PSOCs in Zone III. From the susceptibility analysis, 105 PSOCs received the highest ranking of A.

Management Options

LCA can use a variety of management options to develop a comprehensive approach to source water protection and protect its water supplies from the PSOCs. As LCA is an authority and does not have regulatory powers, they will rely on education as a keystone of their source water protection program. They will target the identified PSOCs, residents of the protection zones, and customers with their outreach efforts. LCA must also work cooperatively with the various municipalities within the protection zones to implement this source water protection plan.

Contingency Plan

LCA maintains an emergency response plan (ERP) and updates it regularly. The plan includes emergency contacts and provisions for alternate sources of water. LCA will work closely with local and county first responders in the event of a spill or accident that may threaten the water supply. LCA also has interconnections with the Salisbury Township and South Whitehall Township water systems and is developing an interconnection with the City of Allentown water system.

New Sources

As part of an approved source water protection management plan, the community water supplier must evaluate alternative sources for long-term supply in the event that an existing source becomes unusable. Over the past several years, LCA has put forth a significant effort to ensure they have sufficient capacity to accommodate future growth in the area and the threat of a contamination event that could result in long term loss of a portion of their current supply. Upgrades to Well 8 and Well 12 which will increase their capacity were completed in December 2009. Also, LCA is in the process of developing interconnections with the City of Allentown's water system. These two steps will significantly increase LCA's ability to address future supply needs related to increased growth or water supply contamination events.

1.0 Introduction

1.1 Project History and Objectives

The Lehigh County Authority (LCA, PWSID #3390073) delivers drinking water to 13 municipalities in Lehigh and Northampton counties. LCA was formed according to the Pennsylvania Municipal Authorities Act in 1966 by Lehigh County. The focus of this plan will be LCA's Central Lehigh Division (CLD). The CLD delivers drinking water to eight municipalities, and the vast majority of LCA's customers. The remaining LCA customers are served by 11 small systems that supply between 9 and 1,000 customers.

LCA wishes to identify the risks to existing groundwater supplies from both a quantity and quality perspective, develop key messages and community education techniques to engage the public in protection efforts, improve dialogue and partnerships with municipalities in the service area, and create common language and understanding around water resources protection data and programs, and increase internal organizational awareness of synergies between LCA and Allentown water systems both before and after system interconnections are completed. Although LCA has had no previous problems, it is concerned about the possibility of contamination from various sources including potential contamination sources around Allentown, agricultural runoff around some of the wells, and the activities listed in the source water protection assessments created in 2004. Therefore LCA desires to protect the local aquifer and the Little Lehigh Creek to protect both historical well supplies and new Allentown supplies.

The objective of this project is to develop a source water protection plan that delineates the recharge areas for the LCA groundwater wells, determines the transport times and pathways of potential contaminants, identifies potential sources of contamination, and complies with Pennsylvania Department of Environmental Protection's (DEP) Chapter 109 regulations (see **Section 1.3**).

1.2 The Importance of Source Water Protection

Developing a source water protection plan has numerous benefits. Some benefits are financial – for example, the reduced cost of water treatment. A recent EPA study estimates that, on average, every \$1 spent on source protection saves \$27 on water treatment and study of water suppliers conducted by the Trust for Public Land and the American Water Works Association in 2002 found that for every 10 percent increase in forest cover in the source area, treatment and chemical costs decreased

approximately 20 percent, up to about 60 percent forest cover (Ernst, 2004). Other benefits are less tangible, including:

- Reduced risk to human health
- Protection of a valuable resource for current and future generations
- Increased consumer confidence in water suppliers
- Support of healthy ecosystems, recreation and other beneficial uses

The economic benefit of protecting a water supply from contamination can be significant. **Table 1-1** lists source water protection case studies throughout the United States. Each of the thirteen communities experienced a contamination problem that could have been avoided by better protection of the water supply. **Table 1-1** lists the contamination problem and the cost needed to either remediate the problem or develop a new water supply.

Scattered throughout this report are additional case studies that provide greater detail regarding how source water supplies can be contaminated and the impact the contamination can have on a community. These case studies are included to reinforce the need to remain vigilant in protecting drinking water for all Pennsylvanians.

This project is funded through the DEP's Source Water Protection Technical Assistance Program (SWPTAP). All community water suppliers (CWS) are eligible to participate in this voluntary program. Costs for the program and plan development are covered by the US Environmental Protection Agency and the Commonwealth of Pennsylvania.

SOURCE WATER PROTECTION
CASE STUDY

Bally, Pennsylvania
Industrial Contamination 2003-2010

In 2003, 1,4-dioxane was found in the Borough of Bally's municipal water, which is supplied by one groundwater well. It was determined that the solvent was used by a local manufacturer of refrigeration systems, which is located a short distance from the Bally municipal well. Seven years later, a new groundwater well was completed and placed online for the 500 homes and businesses currently using bottled water supplied by the industry responsible for the contamination (Youker, 2008, Wilcox, 2010).

1.3 Overview of Source Water Protection Regulations

The Safe Drinking Water Act (SDWA) Amendments of 1996 require that each state develop a source water assessment and protection program (SWAP) for all drinking water sources – groundwater and

surface water – that serve community water systems. The requirements for the SWAP program were adopted by DEP as regulations (Title 25, Chapter 109).

The SWAP program for a community water system (CWS) consists of two parts: assessment and protection. The assessment part is mandatory and is typically completed by the DEP or one of its contractors. Many of the assessments were completed in the early 2000s and provided a very general evaluation of the immediate protection area for existing water sources.

The second part of SWAP – protection – is voluntary. That is, a CWS may voluntarily choose to develop a more detailed, comprehensive, and community-oriented source water protection (SWP) plan following DEP's regulations in Chapter 109. For DEP to approve the plan, the following elements must be included:

- Formation of a steering committee representing, but not limited to, local government entities, water supply customers, farming and business community representatives (as applicable).
- Encouragement of public participation through informational and educational activities.
- Delineation of areas to be protected. For groundwater sources, the protection area is determined using field data and/or a hydrogeologic computer analysis. For surface water sources, the area to be protected is typically the watershed upstream of the intake.
- Inventory of potential sources of contaminants to the source water.
- Development of a management plan to protect the water supply from potential contamination as part of a strategic long-term program.
- Preparation of a contingency plan for emergency response and alternate sources.
- Identification of potential areas for new sources of water for long-term needs.

In 2007, DEP initiated the Source Water Protection Technical Assistance Program (SWPTAP) to help community water suppliers develop a protection plan for their water sources. DEP contracted the engineering firm SSM Group, Inc. (SSM) of Reading, PA to assist water suppliers throughout Pennsylvania develop source water protection plans. All CWS are eligible to participate in this program through their regional DEP office.

1.4 Overview of Water System

LCA's Central Lehigh Division obtains its water supply from 19 wells. The CLD relies upon a treatment system that utilizes sodium hypochlorite (all wells) and green sand filtration at one well.

LCA has experienced high manganese levels at Well 3, intermittent nitrate spikes (approx 9 ppm) at Well 6, and intermittent high total dissolved solids (TDS) at Well 3. Currently, the water system serves an average demand of 6.3 million gallons per day (mgd) and a maximum demand of 8.2 mgd. LCA provides water to a population of 42,000 through 15,089 residential, 557 commercial, and 6 industrial connections in the following 8 municipalities in Lehigh County:

Lehigh County

Weisenberg Township

Lowhill Township

Upper Macungie Township

South Whitehall Township

Lower Macungie Township

Salisbury Township

Upper Milford Township

Borough of Macungie

Water storage for the CLD system consists of four reservoirs and four storage tanks located throughout the service area. The four storage tanks have a capacity of 67,000 gallons. The four reservoirs have a capacity of 7.8 million gallons.

According to the Source Water Assessment Report completed by the DEP in 2004, the aquifer that supplies the wells has been affected by an elevated inorganic chemical level, which is below drinking water standards (DEP, 2004).

1.5 Description of Study Area

The study area for this project includes the City of Allentown, the townships of Weisenberg, Lowhill, Upper Macungie, Lower Macungie, Salisbury, and South Whitehall, and the boroughs of Alburtis and Macungie in Lehigh County, and Longswamp Township in Berks County. The study area is shown in **Figure 1-1**.

The study area was primarily agricultural until a few decades ago. It has been gradually converted from rolling farmland to suburbs that support the urban core of Allentown and Bethlehem, and even Philadelphia to the south and New York/New Jersey to the east. Agriculture remains significant in the

western part of the study area, suburban development dominates many of the municipalities that border Allentown, and Allentown itself is a high-density urban center. While the region has experienced a major loss of manufacturing over the past 30 years, many large facilities are still present in the study area, including the Air Products, Rodale Publishing, Mack Trucks, the Lehigh Valley Hospital, and Dorney Park.

Major transportation routes through the study area include I-78, I-476, Route 309, Route 222, and Route 22. A railroad traverses the southern watershed, winding its way through the boroughs of Topton, Alburtis, Macungie, and Emmaus and then into Allentown.

The study area is included in the Lower Lehigh River Water Planning Area, as designation by the Pennsylvania State Water Plan. The total drainage area for the water planning area is 479 square miles and the main tributaries within the area are Jordon Creek, Lehigh Creek, and Saucon Creek.

There are currently no Total Maximum Daily Loads (TMDLs) for specific pollutants within the Little Lehigh Creek Watershed. However, two segments of the Little Lehigh Creek are designated as impaired, and are scheduled for TMDL development according to the 2008 Pennsylvania Integrated Water Quality Monitoring and Assessment Report. The current timeline has the TMDLs scheduled to be completed by 2021 (DEP, 2008a).

1.5.1 Topography and Hydrogeologic Setting

The central valley of the study area is underlain by predominantly carbonate rocks (limestone and dolomite). These rocks are soluble in water, and dissolve slowly over time to form a karst landscape. Karst is characterized by sinkholes, closed depressions, underground caverns and void spaces. Because precipitation penetrates into the carbonate rocks so easily, there is often limited surface water – few streams, rivers, and lakes. Instead, water flows more quickly and abundantly underground.

SOURCE WATER PROTECTION CASE STUDY

Walkerton, Ontario *E. coli*, 2000

In 2000, seven people died from *E. coli*-contaminated water in the small town of Walkerton, Ontario. Experts believe manure from a nearby cattle field entered one of the municipal wells, possibly helped by several days of heavy rain. The well was not being properly chlorinated, and operators were found guilty of negligence. The outbreak could have been prevented entirely if continuous monitors were installed at the well, as required by law (Hrudey, 2005).

The southern portion of the study area consists of harder, crystalline rocks that make up South Mountain. Compared to the carbonate valley, these rocks do not erode easily, nor do they allow

significant infiltration of rainwater. The high relief of South Mountain is an indication of its resistance to weathering. Ridges along the northwest border of the study area are also comprised of resistant crystalline rocks.

1.6 Existing Source Water Protection Efforts

LCA has a history of active involvement in water supply planning and research. In the mid to late 1980's LCA participated in regional studies of groundwater characteristics and Little Lehigh Creek flows.

Today, LCA is proactively employing multiple source water protection efforts throughout the system. Educational programs, including quarterly newsletters, annual water quality reports, and youth outreach programs, are a cornerstone of LCA's source water protection efforts. LCA plays a leadership role in the annual Hydromania watershed festival that is attended by 1,200 third and fourth grade students from the Lehigh Valley. LCA also held a successful rain barrel workshop in 2009 that they plan to continue in the future and they make multiple educational presentations to school and community groups each year upon request.

LCA maintains an extensive website that includes information on how their customers can help protect water quality throughout the system. The website includes information on topics such as proper disposal of household chemicals and automotive fluids, proper pesticide and fertilizer use and proper vehicle maintenance. To further assist in the proper handling of household hazardous wastes, the system also sponsors and hosts a countywide waste collection event that is run by the Lehigh County Office of Solid Waste twice a year.

Around the water sources, LCA employs a series of fences, locks, and automated alarm systems at their wells and reservoirs. They also encourage customers to be vigilant, and report any suspicious activity they see around the wells and reservoirs.

Source water protection efforts are also in place in neighboring municipalities that will have a positive impact on LCA's water supply. These include:

- Protective zoning ordinances in Upper Macungie Township, including regulating the construction and operation of injection wells; regulating the land application of sewage

sludge; regulating the manufacture, storage, and handling of hazardous substances; and regulating appropriate development near karst features.

- Protective zoning in Lower Macungie Township, including an environmental protection area overlay district to protect environmentally sensitive lands including flood hazard areas, steep slopes, hydric soils, and karst hazard areas from adverse impacts caused by development (zoning ordinance, Article 3 and 18; SALDO, Article 7, Section 794).
- An existing source water protection plan for the Borough of Emmaus.
- A source water protection plan for the City of Allentown water system was developed during the development of this source water protection plan for LCA.

1.7 Previous Studies

This study builds upon previous work completed for the LCA water system. In 2004, the DEP developed source water assessments for the water system through the DEP's Source Water Assessment Program (SWAP). Three separate assessments were completed to address the various LCA divisions. In 2004, three assessments were completed for the LCA water system: one for the Lower Macungie portion of the system, one for the portion of the system north of Route 22, and one for the portion of the system around the intersection of Route 22 and Route 100. These assessments provided cursory overviews of potential contamination sources, and possible management strategies to minimize the risk of polluting the water supply. Several point and non-point source potential sources of contamination (PSOCs) were highlighted in the assessments. Concerns included transportation corridors, on-lot wastewater disposal facilities, and stormwater.