Wellhead Protection Program

Allegheny County, Pennsylvania

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ENVIRONMENTAL CONSULTANTS AND GROUND WATER RESOURCE SPECIALISTS SINCE 1891

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1.0 INTRODUCTION

1.1 Overview of Wellhead Protection Programs

Wellhead protection is a program to prevent pollution of the ground water used for public drinking water. Wellhead protection planning is comprised of:

- A determination of where ground water supplying a public water system is originating from;
- Identifying activities that have the potential to contaminate ground water and;
- Developing a plan to manage these activities to prevent contamination from occurring.

Numerous EPA publications are available to explain the wellhead protection process and to assist communities in the process of development of a wellhead protection plan. A list of wellhead protection references is included with this report.

EPA has identified a five step process to follow to protect public ground water supplies. These five steps are:

1. Form a planning team.
2. Define the land area to be protected.
3. Identify and locate potential contaminants.
4. Manage the protection area.
5. Plan for the future.

Moody and Associates, Incorporated (Moody's) was primarily responsible for completion of step 2, the delineation of wellhead protection areas. Moody's also provided input to the Allegheny County Planning Department (ACPD) and the Allegheny County Health Department (ACHD) for the other four steps.

1.2 Wellhead Protection Program In Pennsylvania

The following information is from a Pennsylvania Department of Environmental Protection guidance document prepared in May 1993.

The responsibilities for development and implementation of the Wellhead Protection Program (WHPP) in Pennsylvania will be shared between public water suppliers and state and local governments. Public water suppliers are responsible for assuring the continuous supply of safe and potable water to the user. In Pennsylvania, it is recognized that the authority to regulate land use is primarily seated in the local governments whereas the Commonwealth has primary enforcement responsibility (primacy) in regulating public water supplies and also regulates most discharges of potential contaminants. The Department of Environmental Protection (DEP) is the primacy agency for the Safe Drinking Water Act in the Commonwealth and the Division of Drinking Water Management in the Bureau of Water Supply and Community Health is responsible for administering the WHPP in Pennsylvania. In Allegheny County these responsibilities are also shared by the Allegheny County Health Department (ACHD).

The PA DEP lists the following as the components of a comprehensive WHPP.

I. Summary and Purpose of the WHPP
II. Designation of Responsibilities
III. Delineation of Wellhead Protection Areas (WHPA)
IV. Identification of Contaminant Sources
V. Development of Management Approaches
VI. Contingency Planning
VII. New Water Supply Source Protection
VIII. Public Participation

The WHPP is a proactive effort designed to apply proper management techniques and various preventive measures to protect ground-water supplies. The underlying principle of the program is that it is much less expensive to protect a resource than it is to try to restore it once it becomes contaminated.

1.3 History of Contamination

The urban, industrial and commercial nature of development in Allegheny County has left the local environment at risk to contamination from man-made sources, such as chemicals, solvents and waste products. Some water supplies and water supply wells in Allegheny County have been severely affected by such contamination.

The Borough of Blawnox completed construction of a water treatment plant in 1979; subsequently the Borough detected contamination of its water supply by the Volatile Organic Chemical (VOC) Trichloroethylene (TCE), which exceeded the maximum contaminant level (MCL) of five parts per billion (PPB). The new treatment plant could not reduce TCE levels to below the MCL and had to be abandoned. The Borough has been purchasing water from a neighboring water system but is still obligated to pay off the debt from the unused water plant.

The Borough of Springdale also detected levels of TCE in the Borough water supply, in the early 1980's, which exceeded the MCL. In 1991, the Borough completed construction of a packed tower aeration unit which cost in excess of $300,000 to install. Fortunately, the Chevron Corporation paid for construction of the unit, but the Borough must pay for continuing operation and maintenance.

Two downtown office buildings in Pittsburgh recently discovered the VOC, Tetrachloroethylene (PCE) in their water supplies. One system installed an innovative air stripping system, at a cost of over $50,000, to remove the PCE. The other abandoned its water supply and connected to the municipal water system.

The Borough of Sharpsburg discovered contamination in excess of MCL's in all of the wells located in the well field at the treatment plant and has had to abandon those wells. Fortunately, the Borough has two other uncontaminated wells at another location and is able to continue to produce drinking water safe for consumption.

All of these contamination incidents have related costs and consequences for the water suppliers and their customers.

1.4 Previous Well Head Protection Activities

Nationwide experience has shown that it is much more practical and cost effective to plan to prevent contamination of ground water sources than to clean it up after it occurs. However, as of 1992, none of the ground water systems in Allegheny County had implemented formal well head protection programs to prevent future contamination.

As a first step toward implementing the well head protection process, ACHD and the Pennsylvania Rural Water Association (PRWA), with funding from the Kellogg Foundation, completed a Ground Water Policy Education Project in 1993. The goal of the education project was to increase the knowledge of local officials, water authority members and water treatment plant operators regarding the five-step well head protection process. Through a one-day seminar, well field walking tours and twelve special presentations, awareness of the need to protect ground water sources was increased. Moody and Associates also participated in the Education Project. Preliminary lists of potential sources of contamination were prepared for each of the eleven operating community ground water systems. Suppliers were shown that because their ground water resource areas often include land in neighboring municipalities, intergovernmental cooperation is critical to the success of the well head protection programs.

Implementation of complete and effective well head protection programs can be a costly process. Precise delineation of well field protection areas requires thorough assessment of the well field. Zoning ordinances and other management tools must be thoughtfully developed. Many of the communities with ground water supplies have suffered through at least a decade of a disappearing industrial base, which has resulted in diminished tax revenues. Water systems in these communities sometimes struggle to obtain funding just to properly operate and maintain the system; well head protection programs had been viewed as an added expense which has not been a priority.

However, significant change has already begun, partially due to the success of the education project. Twelve municipalities and four water authorities submitted letters to the Commonwealth in support of the Allegheny County Well Head Protection Program, evidence of their heightened awareness of the need to protect their valuable ground water resources. The Borough of Springdale has taken action to protect its well sources by removing a leaky underground gasoline storage tank, requiring a sewer line to replace industrial septic systems, and cosponsoring a hazardous waste collection day. ACHD and PRWA have prepared a ground water education pamphlet for distribution to all customers of the ground water systems and any other interested parties.

1.5 Program Participants

The Allegheny County Wellhead Protection (WHP) program represents a joint effort by County, State, and Local government agencies and bodies and the project consultant. The project was funded by a grant from the Pennsylvania Department of Environmental Protection. The project contract was administered by the Allegheny County Planning Department (ACPD). Project direction was provided jointly by the ACPD and the Allegheny County Health Department (ACHD).

Twelve public water suppliers were initially included in the WHP program. In addition, H.J. Heinz Company, which is a non-transient, non-community water supply system, was included in the study because they were one of the largest ground water users in Allegheny County.

Those water systems which participated in the study included the following:

- Borough of Aspinwall
- Borough of Cheswick
- Borough of Coraopolis
- City of Duquesne
- Municipal Authority of the Borough of Edgeworth
- Municipal Authority of the Township of Harmar
- H.J. Heinz Company
- Moon Township Municipal Authority
- Borough of Sewickley Water Authority
- Township of Shaler
- Borough of Sharpsburg
- Borough of Springdale
- Municipal Authority of the Borough of West View

The location of these systems are shown on FIGURE 1.5.1

During the data acquisition phase of the project, it was determined that the City of Duquesne was planning to purchase water from an adjoining system and discontinue use of their own wells. Also during the data acquisition phase, it was determined that the Municipal Authority of the Borough of West View does not use or plan to use their water wells on a regular basis. At the present time, West View wells are only maintained for emergency back-up use.

Following consultation with ACHD and ACPD, it was determined not to continue completion of detailed wellhead protection delineations and subsequent steps for these two systems.

The systems included in this study routinely supply drinking water for approximately 125,000 people residing in 25 municipalities in Allegheny County. This population utilizing ground water represents approximately 10 percent of the population in Allegheny County. In addition to the public water systems, approximately 45,000 citizens are supplied by an estimated 15,000 private wells (ACHD, 1993).

1.6 Project Goals And Purpose

The overall goal of the project was to insure that the systems participating in this study are able to continue to provide reliable, efficient, and safe drinking water for their customers and citizens of Allegheny County.

The completion of wellhead protection plans represent a vital and integral part of the planning process to insure the best quality water is available both now and in the future.

Specific goals of the WHP management project are outlined below.

- To inform local officials of the WHP project and seek their support, input and cooperation.

- To compile available physical data relative to wells and well fields to provide the necessary database to support the Allegheny County WHP programs.

- To develop a computer model of the hydrogeologic systems associated with each respective well field.

- To delineate the wellhead protection area (WHPA) for each of the system well fields based on time of travel and particle tracking from the computer model.

- To complete an inventory of potential sources of contamination.

- To review existing ground water monitoring and the monitoring network.

- To locate, install and sample monitoring wells in the study area.

- To identify management strategies that can be used to develop a comprehensive wellhead protection program.

- To develop and implement a wellhead protection program for Allegheny County.

- To conduct a WHP conference at the end of the project to present the results and findings of the study.

FIGURE 1.5.1

ALLEGHENY COUNTY WELLHEAD PROTECTION STUDY AREA LOCATION

NORTH

SCALE: 1 inch = 5 miles

2.0 STUDY AREAS

2.1 Locations

The communities, authorities and systems that participated in the Allegheny County WHP study are all located adjacent to the three major rivers which flow through the county. Similar physical settings which include alluvial terraces and flood plains exist adjacent to the rivers throughout Allegheny County. These flood plains have historically been the areas where development occurred first and has been the most intense. In this century, the river fronts were the primary location of Allegheny County's major industries.

All of the water system well fields are located in flood plains along the Ohio, Allegheny and Monongahela Rivers.

The location of communities for which detailed WHP delineations were completed are shown on FIGURES 2.1.1, 2.1.2, 2.1.3, and 2.1.4. These figures are all portions of United States Geological Survey (U.S.G.S.) 7.5 Minute Topographic Quadrangle maps.

2.2 Geological Setting

Allegheny County is located in the Allegheny Plateau Physiographic Province (Gallaher, 1973). Bedrock or consolidated rocks cropping out (exposed) in Allegheny County have a total thickness of about 1,300 feet. These formations are comprised primarily of sandstones and shales with some interbedded clay, limestone and coal units. These rock units are relatively flat lying and do not generally yield quantities of ground water sufficient for municipal water system use.

The unconsolidated deposits which overlie bedrock in the major river valleys in the County are of Quaternary (recent) age and Pleistocene or Ice Age.

The basal or lower unconsolidated unit is commonly comprised of sand and gravel along the Allegheny and Ohio Rivers and is of Pleistocene Age. The sand and gravel deposits along the Allegheny and Ohio Rivers are generally coarser due to their origin from glacial melting. Deposits along the Monongahela River are of finer texture and they were derived from the rock units which occur within the local drainage basin.

All aquifers of concern in the WHP Study areas are gravel aquifers which occur adjacent to and beneath the rivers.

The typical thickness of valley fill deposits in Allegheny County ranges from 50 to 70 feet and averages approximately 60 feet. At no place along the river valleys in Allegheny County is bedrock recorded at a depth in excess of 85 feet below river level (Adamson, et. al, 1949). The bedrock valley floor is relatively flat, however it does rise and the valley fill deposits thin along the bedrock valley walls throughout Allegheny County.

Although the thickness of alluvial units may average 60 feet, not all of the thickness is comprised of sand and gravel deposits. Alluvial units also contain interbedded silts and clays.

The prolific water bearing sand and gravel aquifers adjacent to the rivers are typically 10 to 40 feet in thickness and generally have an absence of or very small percentage of fine silt and clay. The coarse sand and gravel valley fill deposits characteristically have higher permeability and porosity and therefore are the target aquifers for development of high yield water wells in Allegheny County.

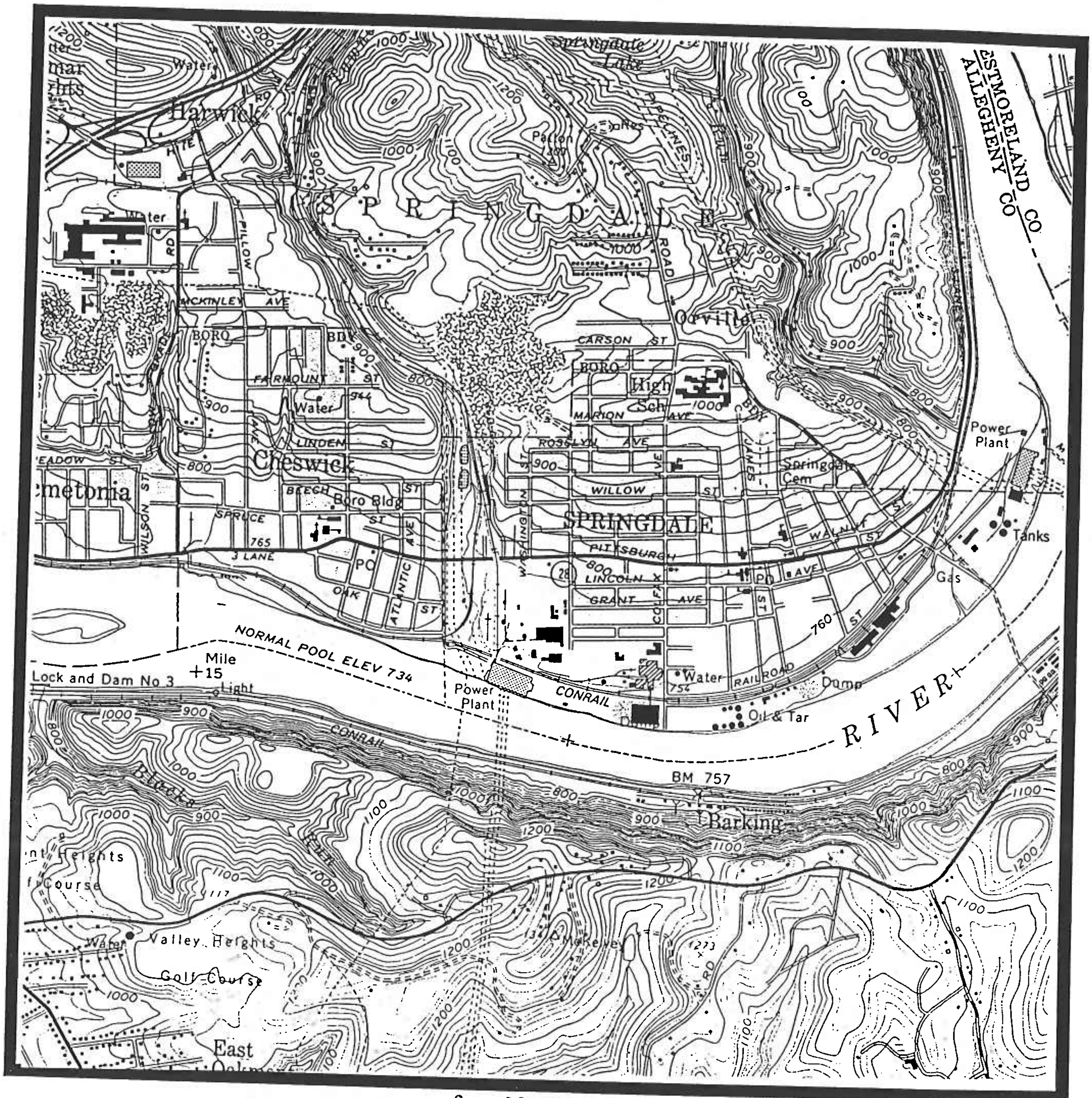
2.3 Land Use Setting

The water systems included in the Allegheny County Wellhead Protection Plan are all located in urban settings. All water systems are in communities with extensive residential, commercial and industrial development. These areas have all been subject to various types of development during the past 100-200 years.

The porous and permeable characteristics of the valley fill aquifers make them vulnerable to potential pollution sources. Rates of movement of contaminated ground water as rapid as 50 to 100 feet/day have been documented in valley fill aquifers in Allegheny County.

The valley fill aquifers in Allegheny County are considered susceptible to ground water contamination and development of wellhead protection plans is viewed as an extremely cost effective procedure to avoid or minimize water treatment costs or water supply replacement costs.

FIGURE 2.1.1



from New Kensington West, PA USGS Quadrangle Map

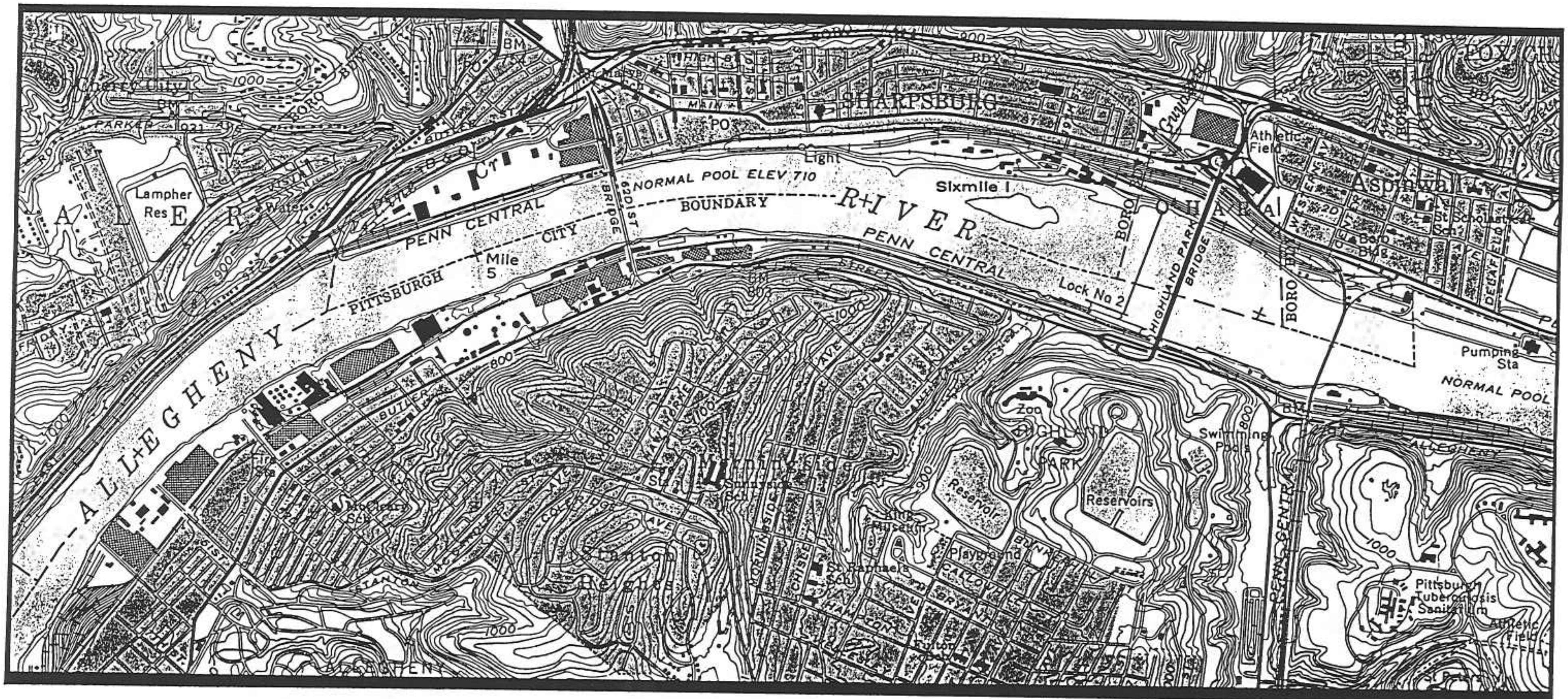
LOCATION MAP: STUDY AREA #1
SPRINGDALE, CHESWICK AND HARMAR WELL FIELDS

NORTH

SCALE: 1 inch = 2000 feet

FIGURE 2.1.2

LOCATION MAP: STUDY AREA #2
ASPINWALL, SHARPSBURG AND SHALER WELL FIELDS



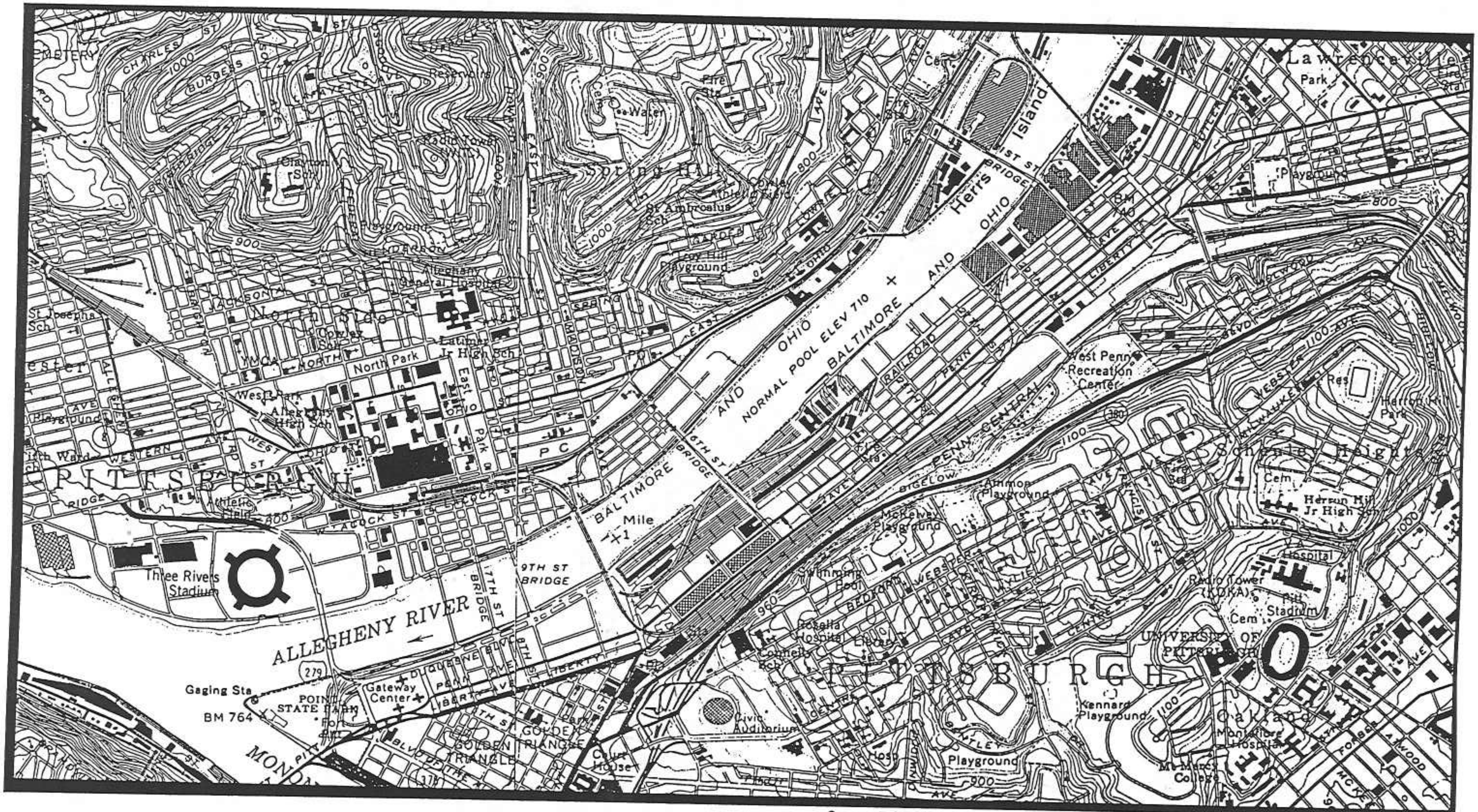
from Pittsburgh East, PA USGS Quadrangle Map

SCALE: 1 inch = 2000 feet

NORTH

FIGURE 2.1.3

LOCATION MAP: STUDY AREA #3
H. J. HEINZ CO. WELL FIELD



from Pittsburgh East and Pittsburgh, PA USGS Quadrangle Map

SCALE: 1 inch = 2000 feet

NORTH

FIGURE 2.1.4

from Ambridge, PA USGS Quadrangle Map

LOCATION MAP: STUDY AREA #4
CORAOPOLIS,, SEWICKLEY, MOON AND EDGEWORTH WELL FIELDS

NORTH

SCALE: 1 inch = 2000 feet

3.0 DELINEATION METHODOLOGY OF WELLHEAD PROTECTION AREAS

3.1 Discussion of Delineation Methods

Of the five step process for establishing a wellhead protection program recommended by the US Environmental Protection Agency, the delineation of the wellhead protection area is the most technical step. A wellhead protection delineation area is the ground surface expression of the area of the aquifer, and associated recharge areas, that provides water to a well. This area, commonly termed the capture zone or the zone of contribution, can be refined using time of travel determinations. Most wellhead protection delineations are defined as the area in which ground water will move to a well within five or ten years. In Pennsylvania, the definition of wellhead protection areas (WHPA) establishes three possible zones of protection. Zone 1 is the area immediately surrounding a well and may range from a radius of 100 to 400 feet, depending on the pumping well and the characteristics of the aquifer. Zone 2 is a radius of ½ mile or a more detailed delineation established to identify the area overlying the portion of the aquifer through which water is diverted to a well. Zone 3 is the area which contributes surface water or ground water to Zone 2 which may be significant to protecting the wellhead protection area. The wellhead protection areas calculated by this study would constitute a Zone 2 protection area. The Zone 3 wellhead protection area would encompass the adjacent bedrock upland watersheds that provide recharge to the areas delineated in this study.

The US EPA recommends several methods for delineating the wellhead protection zone of contribution. These methods are, in order of increasing complexity and data requirements, arbitrary fixed radius, calculated fixed radius, uniform flow equation, analytical and semi-analytical modeling, hydrogeologic mapping and vulnerability assessments, and numerical modeling.

The arbitrary fixed radius and calculated fixed radius methods yield a circular protection zone, centered on the well or well field to be protected. Uniform flow equations generate a protection zone that consists of a semicircle downgradient of the well and a semi-rectangular area upgradient of the well, extending to a ground water divide or source area. The size of these two areas is determined by solving simple algebraic expressions. These two methods require little data collection and can be generated very quickly. However, they are extremely simplified generalizations of the zone of contribution to a well. They cannot account for interference effects between multiple wells or any boundaries or heterogenities in the ground water flow system.

Analytical and semi-analytical modeling requires more complete data on the aquifer and the wells to be protected. These methods can account for simple boundaries in the ground water flow system as well as multiple wells. However, the assumptions required to simplify the data for the models require that the parameters used to construct the models be assumed to describe the aquifer conditions throughout the modeled area and cannot account for complex boundary geometries or heterogeneous aquifer conditions. The area of contribution is determined by computing drawdowns using an analytical equation, superimposing this drawdown on the prepumping water table surface, and sketching the area of diversion or contribution from the resultant water table surface. Areas of recharge and discharge are simulated using image wells, which are placed in the system on the basis of aquifer geometry. The pumping or injection rates of the image wells are calculated to simulate the boundaries of the flow system. Analytical and semi-analytical modeling, using image well theory, assumes two-dimensional ground water flow with fully penetrating, linear boundaries.

Hydrogeologic mapping and vulnerability assessments require determination of flow boundaries based on lithographic variation or permeability contrasts within the aquifer and the observed behavior of the flow system. This method requires significant data collection for the compilation of geologic maps, water table maps, areas of vulnerability and time of travel calculations. Assuming that sufficient data is collected, this method yields a good but static determination of the zone of contribution. Any changes to the system require additional data collection and mapping.

Numerical modeling requires the most intensive data collection and resources. Complex flow system boundaries, changes in aquifer conditions, multiple wells and multiple aquifers can be addressed by this method. Numerical modeling, when the models are sufficiently calibrated, can also provide a predictive tool to examine the response to any changes in the flow system or well field. The application of a numerical flow model involves several steps, including conceptualization of the hydrogeologic system, data collection, model construction, model adjustment and calibration, and prediction of the hydrogeologic flow system behavior. The flow system is first conceptualized, which is a simplification and quantification of the actual system elements. An appropriate model is selected and constructed to represent the conceptualized aquifer system. The study area is then divided into cells that represent boundary conditions, areas of heterogeneity, and define the flow into and out of the modeled area. Aquifer parameters are adjusted until the model accurately simulates observed behavior of the hydrogeologic system. Finally, the model output of simulated aquifer behavior is used by a particle tracking program to calculate the approximate contributing area to a well or well field. Numerical flow models constructed to simulate ground water flow in two dimensions adequately approximate contributing areas in valley-fill aquifers where the aquifer is less than 100 feet thick and vertical hydraulic conductivity, which is a measure of an aquifer materials ability to conduct water, is less than ten times the horizontal hydraulic conductivity (Risser and Madden, 1994).

3.2 Applicability of Numerical Modeling in this Setting

The aquifer system of the study area consists of buried sand and gravel deposits of fluvial-glacial origin. The irregular geometry of aquifer boundaries, complex river system/aquifer communication, and density of high capacity wells in the unconsolidated fluvial-glacial aquifers of the study area require a model system with the capability of reproducing these features to adequately describe the actual aquifer behavior.

Calculated fixed radius and uniform flow methods generally are limited for use in determining wellhead protection zones in valley fill aquifers with multiple, high yielding wells. These methods cannot account for interference between wells, complex aquifer geometries or heterogeneous aquifer characteristics.

Analytical and semi-analytical models have been applied in this type of setting, however, the necessary simplifying assumptions limit the use of these models to settings where the boundaries of the aquifer system have simple geometries, with stream boundaries that fully penetrate the total depth of the aquifer. These models also assume a uniform prepumping water table surface. In actual aquifers, irregularly shaped water table surfaces, heterogeneous aquifer materials, complex aquifer boundary geometries, and the potential for inducing ground water flow beneath river boundaries through well drawdowns can limit or greatly restrict the use of these types of models in determining a wellhead protection area.

Numerical flow modeling is a powerful tool for studying the effects of pumping on a ground water flow system. These models are able to simulate most factors that affect the contributing area of a well, including complex boundary geometries, partially penetrating rivers, complex patterns of recharge and discharge in the system, and spatially heterogeneous aquifer properties.

The complex aquifer boundaries, heterogeneity of aquifer parameters, and complex river-aquifer interactions found within Allegheny County require the use of a numerical model to determine the well head protection areas. Numerical modeling, when used with a particle tracking program, is considered the most rigorous method for delineating areas of contribution or well head protection areas. However, numerical modeling requires simplification of the aquifer system during the flow system conceptualization and model construction phases of this method, so areas delineated by this method are approximations (Risser and Madden, 1994).

3.3 General Conceptual Model and Assumptions

The valley fill aquifers of the Allegheny and Ohio River valleys within Allegheny County are fluvial-glacial in origin. The aquifers are primarily composed of sand and gravel deposits emplaced on the bedrock valley floor. These sand and gravel aquifers average approximately 60 feet in depth. The saturated thickness of the aquifers in the study area ranged from 25 to 35 feet thick. The unconsolidated sediments located above the sand and gravel aquifers range in lithology from clay to sand and gravel, and also include man-made fill.

The conceptual model constructed of this aquifer system consists of one layer, with a bottom surface corresponding to the bedrock valley floor and a thickness set to the average thickness of high yielding sand and gravel deposits found in the study area.

Potential sources of ground water flow in the aquifer system are aerial recharge, recharge from the underlying bedrock, and recharge through the beds of the rivers and their tributaries. Potential sinks or discharge locations for ground water flow are pumping wells and the rivers.

Data describing the aquifer and ground water flow characteristics was collected for the study area. Some of the sources of information include geologic maps, water supply system records of well construction and lithology logs, pumping and step pumping tests, physical descriptions of the water supply systems, and other relevant reports provided by the water systems. Extensive data was available from files and records maintained by the Allegheny County Health Department. Other sources of data are geological reports on valley-fill aquifers both in Allegheny County and in other similar geologic settings and Moody and Associates, Incorporated's in-house records and reports.

Once the conceptual model is constructed, the numerical model is chosen and constructed to simulate the conceptual model. After the model is calibrated using observed, actual system behavior, the numerical model is used to determine the capture zones or zones of diversion for wells within the aquifer system. The capture zones were calculated using the United States Geological Survey MODFLOW (McDonald and Harbaugh, 1988) and MODPATH (Pollock, 1989) numerical modeling packages.

In the numerical model construction, the aquifer is divided into cells by superimposing a grid over the study area. The physical and hydrogeologic parameters for each cell or node are then determined. Four distinct study areas were used to include the water systems obtaining ground water from the valley fill aquifers of Allegheny County. Three of the study areas are located on the Allegheny River, and one is located on the Ohio River. The first study area includes the Springdale, Cheswick and Harmar well fields. The second study area includes the Aspinwall, Sharpsburg and Shaler well fields. The H. J. Heinz Co. well field is contained in the third study area and the Coraopolis, Moon, Sewickley and Edgeworth well fields are located in the fourth study area.

The numerical model used for this study consists of one layer. The layer is one cell thick, with the lower boundary being the bedrock valley basement. The cell thicknesses varied over the study area depending on the thickness of the high yielding sand and gravel deposits.

The cells within each study area are assigned as active or inactive. Active cells contain the valley fill aquifer sands and gravels. The inactive cells designate areas outside the aquifer that are underlain by bedrock. No flow is assumed in the inactive cells. Also, all boundaries within the system must be explicitly described. The flow from the underlying bedrock into the aquifer system was assumed to be negligible, thus the boundary between active and inactive cells and the lower boundary of all active cells, representing the contact between the aquifer and the underlying bedrock, was set as a no flow boundary. The inflow and outflow areas in each study area are designated as constant head cells, meaning that these cells will act as infinite sources or sinks of water to the flow system. Variable grid spacing was used in the models to allow greater precision in the areas of ground water withdrawal.

Once the study area grid cells are defined, the potential sources and sinks found within the area are described. The sources and sinks found within the study area are aerial recharge, pumping wells, and the river systems. Aerial recharge is a source of water, and is set at 0.004 feet per day over each study area. This value is approximately nine inches of aerial recharge per year, which is one fourth of the total average precipitation for this area (Geraghty, et al., 1973). The pumping wells are ground water sinks, and are located in the cells containing the actual existing pumping wells or well fields. The Sewickley crib was evaluated as a special case and is simulated by designating the four cells containing the crib as drain cells. A drain differs from a well in that the water entering a drain cell exits the flow system, but pumping from the drain does not occur. The parameters of the drain cells, mainly the hydraulic conductivity and the elevation of the drain, were adjusted until the amount of water leaving the flow system in the drain cells approximated the quantity of water that Sewickley obtains from the crib.

The river system is simulated by designating cells containing the rivers as river cells. A cell is described as a river cell by assigning a positive riverbed conductance, an elevation of the riverbed and the head of the river to the cell. The riverbed conductance of a cell is a factor of the hydraulic conductivity of the riverbed sediments, the thickness of the sediments and the length and width of the river segment contained by the cell. Direct measurement of the riverbed conductance is beyond the scope of this project, and our data collection efforts have not discovered any existing studies which quantify the conductance. The riverbed conductance is estimated by using the ratio of conductance to the sediment thickness. The model was run three times, using ratios of 0.1, 1.0 and 10.0 of riverbed conductivity to sediment thickness. This variation is assumed to cover the range of reasonably expected values. (Morrissey, 1989) A river cell can act as both a source and a sink to flow within the aquifer system. Under normal, non-pumping conditions, ground water would discharge to the river. In river reaches near areas of extensive ground water withdrawal, the river will act as a source of water if the hydraulic head is lowered to an elevation below the river surface. If, as a result of pumping, the hydraulic head beneath the river is lowered to an elevation below the riverbed, ground water flow is induced to pass under the river from the aquifer underlying the opposite bank.

In conjunction with the model sources and sinks, the aquifer properties are described. Porosity, vertical aquifer extent, hydraulic conductivity and an initial hydraulic head, or ground water potential elevation must be specified. A porosity of 0.2, or 20 percent was used over the active cells in each of the study areas. The initial hydraulic head was determined from the collected data, with the gradient of the piezometric surface set to reflect the valley bedrock floor gradient across the study area. The piezometric surface is the surface representative of the level to which water will rise in a well cased in the aquifer. This surface is also called the water table in an unconfined aquifer, which is an aquifer that is not covered by material of significantly lower permeability. In a confined aquifer, or an aquifer that is covered by material of lower permeability, the piezometric surface is higher than the physical top of the aquifer. The hydraulic conductivities utilized within each study area are derived from pumping and step pumping test data collected from the individual systems. These values fall in the range of expected hydraulic conductivity found in glacial-drift, river valley aquifers which range from approximately 10 to 10,000 feet per day. (Lyford and others, 1984)

The numerical flow model was calibrated to the pumping levels observed within the study area well fields. The numerical models were constructed using data provided by the municipal systems involved in the study. Generally, the aquifer parameters were calculated from data generated when wells were first drilled. In this way, calculated aquifer parameters would not be affected by changes in well performance due to age and screen degradation. The data provided for a general numerical model that simulates the regional flow patterns of the valley fill aquifer in the area of a well field. The resolution of the model did not allow for small scale heterogenities within the aquifer. In several systems, wells of relatively close proximity exhibit differing yields and drawdowns, which translates to different aquifer parameters calculated for each well. In these cases, a system-wide average was compiled to determine the calculated aquifer characteristics. As a result, the simulated drawdowns did not always match each individual well, but the simulated drawdowns compared well with the system wide observed behavior.

Once the numerical model was constructed and calibrated, three simulation runs were performed using the three ratios of riverbed hydraulic conductance to sediment thickness. The first step in these simulation runs is to run the MODFLOW program using the parameters for each study area. The results from MODFLOW consist of hydraulic head elevations over the study area. The calculated hydraulic head distribution found across the study area, along with the aquifer properties, is then used by the MODPATH program to construct a ground water velocity field within the study area. Particles are then placed in this ground water velocity field and traced either forwards or backwards through the aquifer flow system.

For the capture zones calculated in this study, particles were placed at the location of the well or well fields and traced backwards. The capture zones are constructed by overlying the results of the three MODPATH simulations and drawing a capture zone for each well field containing all flow lines that terminate at the individual well fields. The calculated capture zones are not time dependent. The particle paths are traced backwards from the well locations to the source of that particle, regardless of the time of travel necessary for the particle to move through the flow system.

Another measure of the relative error in a numerical model is the water balance error. The water balance error compares the total simulated inflows and outflows as computed by the water balance. The difference between total inflow and outflow is divided by either the inflow or the outflow to yield the error in the water balance. Ideally, the error in the water balance is less than 0.1%, however, and error of around 1.0% is usually considered acceptable (Anderson and Woessner, 1992)

4.0 WELLHEAD PROTECTION AREA DELINEATIONS

4.1 Study Area Number 1: Springdale, Cheswick and Harmar

The conceptual model for the study area including the Springdale, Cheswick and Harmar well fields consists of one layer, 30 feet thick. The bottom of this layer is at an elevation of 679 feet mean sea level (MSL) at the northeast end of the study area. The layer drops in elevation, southwest across the area to 672 feet MSL at the southwest corner. The river elevation is set at 734 feet MSL above Dam Number 3, and 721 feet MSL below the dam.
The following table lists the pumping rates used in the model construction for the well fields located within the study area. The pumping rates are expressed in gallons per day.

TABLE 4.1.1 PUMPING RATES

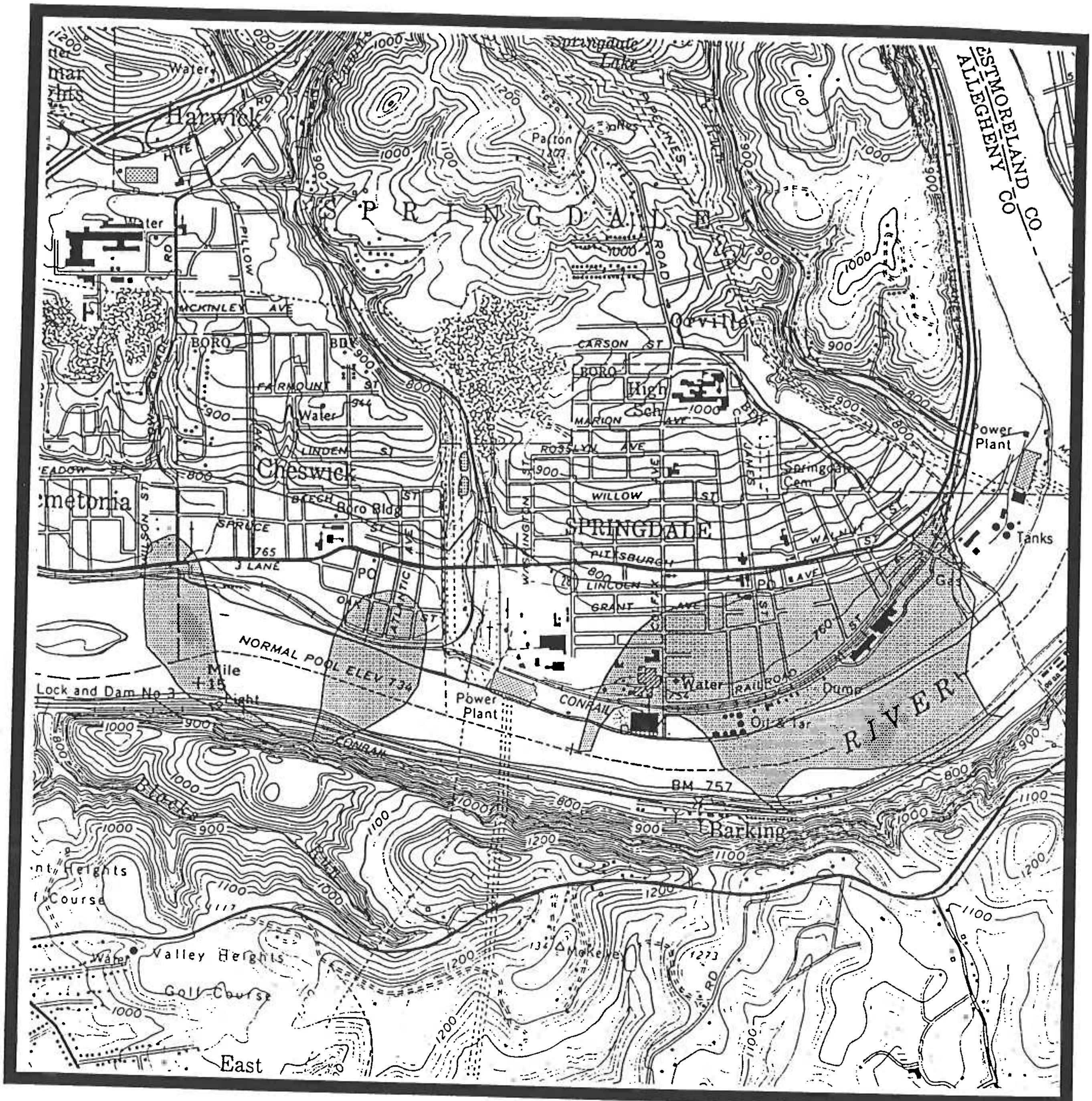
Well Field	Location	Pumping Rate
Springdale	Borough of Springdale	500,000
PPG	West of Springdale Well Field	2,016,000
Duquesne Light	Between PPG and Cheswick	1,440,000
Cheswick	Borough of Cheswick	225,000
Harmar	Harmar Township	700,000
Westinghouse 1	Next to Harmar Well Field	1,440,000
Westinghouse 2	West of Harmar Well Field	2,880,000
Saxonburg	Harmar, near Route 28 and Interstate 76 interchange	150,000

FIGURE 4.1.1 illustrates the calculated capture zones for the three municipal systems included in this study area. Although the industrial wells and the Saxonburg wells are not displayed in FIGURE 4.1.1, they were assumed to be in operation during the simulation runs. The effect of these wells, and the ground water flow around Dam Number 3, accounts for the unusual shapes of the capture zones.

The modeling grid used to construct the numerical model of this study area is shown in FIGURE 4.1.2. The cells within the modeling grid that are specified as active, inactive, and constant head boundary cells are shown in FIGURE 4.1.3. FIGURE 4.1.4 illustrates the cells that were designated as river cells. The hydraulic conductivities, expressed in feet per day, used in the construction of the numerical model ranged from 450 to 1600. The distribution of values used to express the hydraulic conductivity are shown in FIGURE 4.1.5.

The water balance error for the simulation runs of the numerical model for this study area are 0.11%, well below the acceptable range of 0 to 1 percent. The simulated pumping levels for the Springdale and Cheswick wells are within two feet of the observed pumping levels. There is less than five feet of difference in the simulated versus observed pumping levels in the Harmar wells, with the simulated water levels showing excess drawdown at this well field. It is assumed that this is the result of the close proximity of the high capacity Westinghouse wells, Two of which are within 200 feet of the Harmar wells. The Westinghouse wells are not constantly pumped, but are cycled. For the purposes of model construction, the daily production of these wells was averaged over the entire day, and pumping was assumed to take place on a constant basis. This constant pumping in close proximity to the Harmar wells results in the lower simulated than observed pumping levels.

FIGURE 4.1.1



from New Kensington West, PA USGS Quadrangle Map

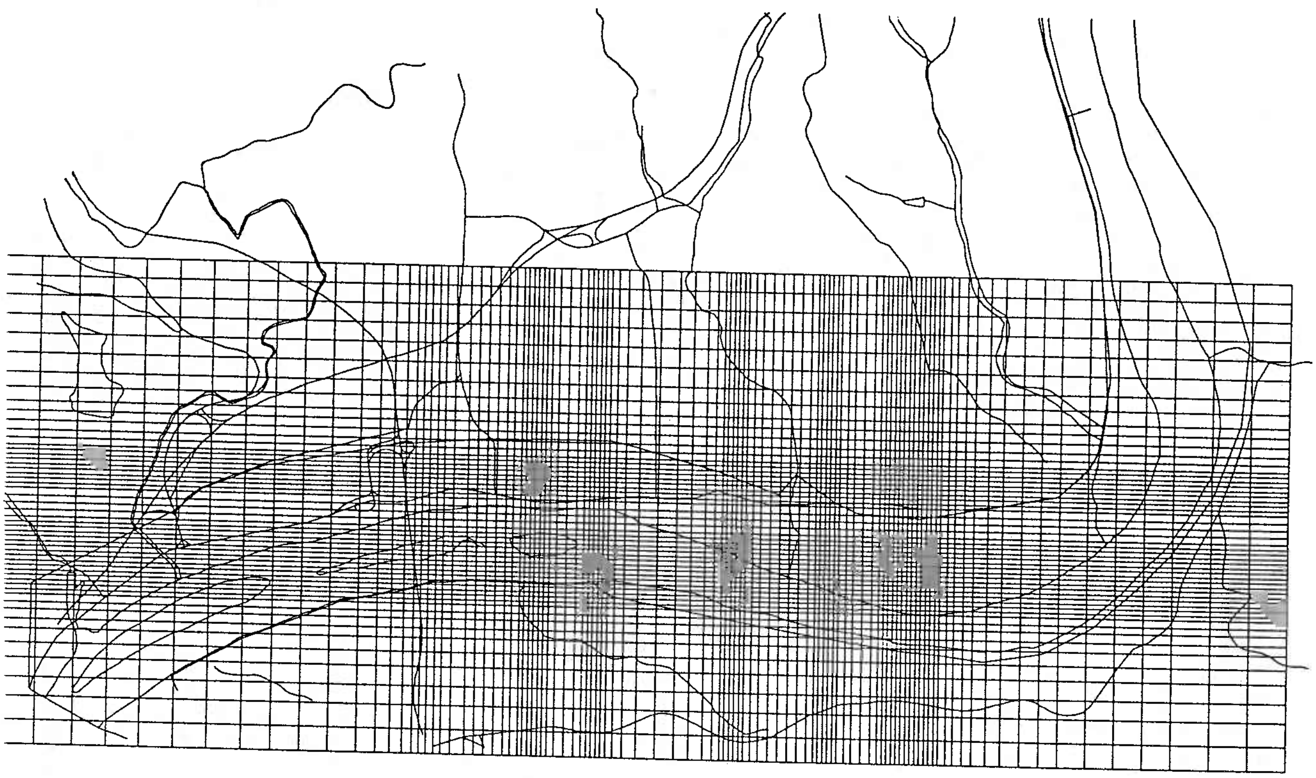
CALCULATED CAPTURE ZONE: STUDY AREA #1
SPRINGDALE, CHESWICK AND HARMAR WELL FIELDS

NORTH

SCALE: 1 inch = 2000 feet

FIGURE 4.1.2

MODELING GRID FOR STUDY AREA CONTAINING SPRINGDALE, CHESWICK AND HARMAR WELL FIELDS

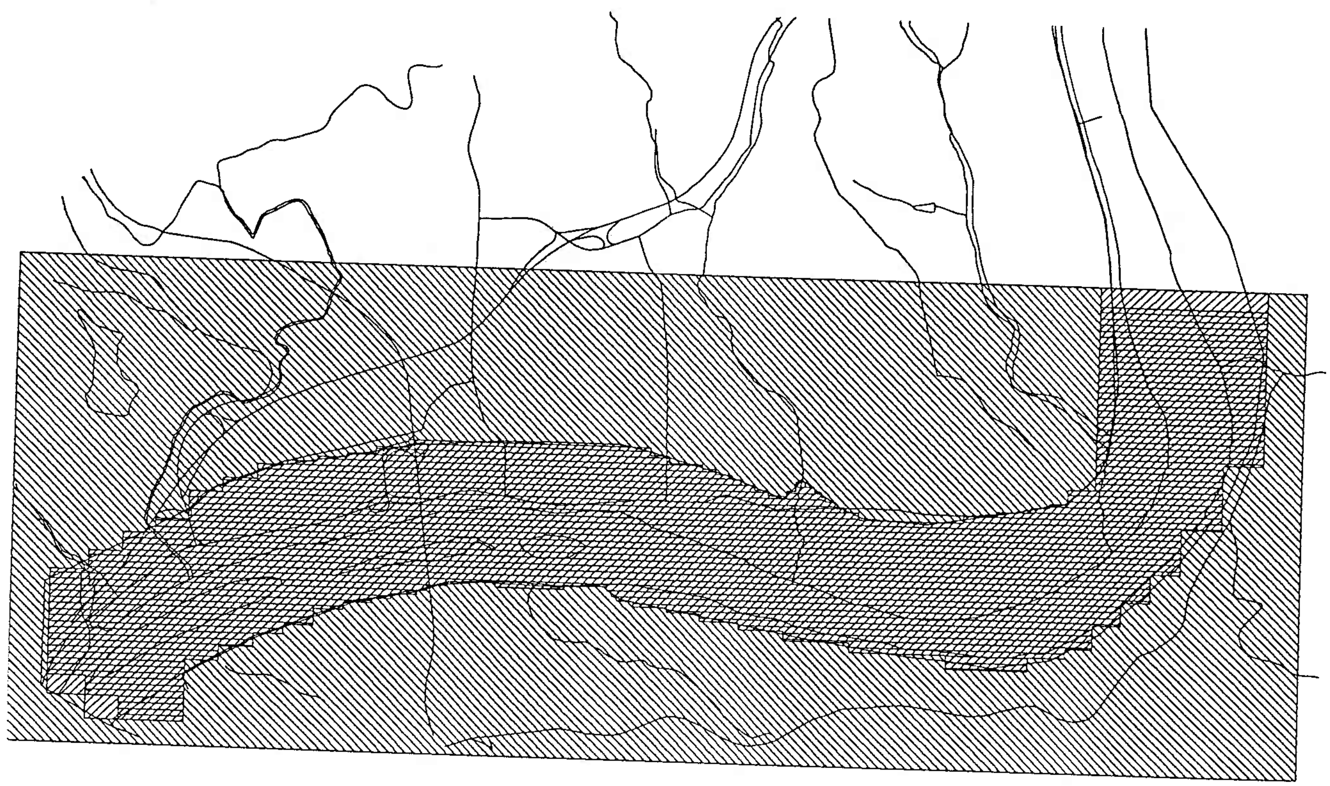


SCALE: 1 inch = 4000 feet

NORTH

FIGURE 4.1.3

CELL DESIGNATIONS FOR STUDY AREA CONTAINING SPRINGDALE, CHESWICK AND HARMAR WELL FIELDS



SCALE: 1 inch = 4000 feet

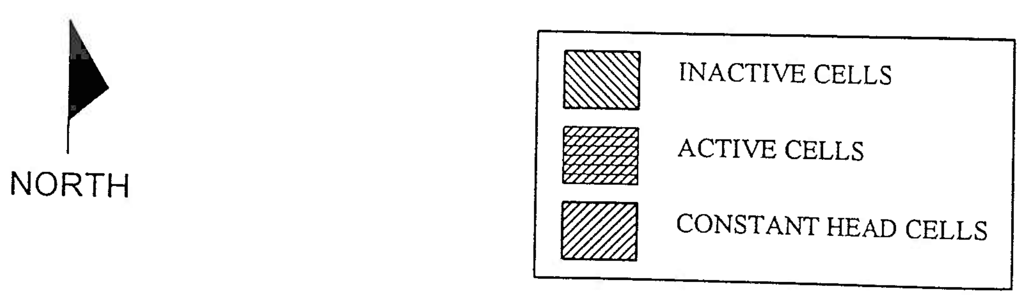
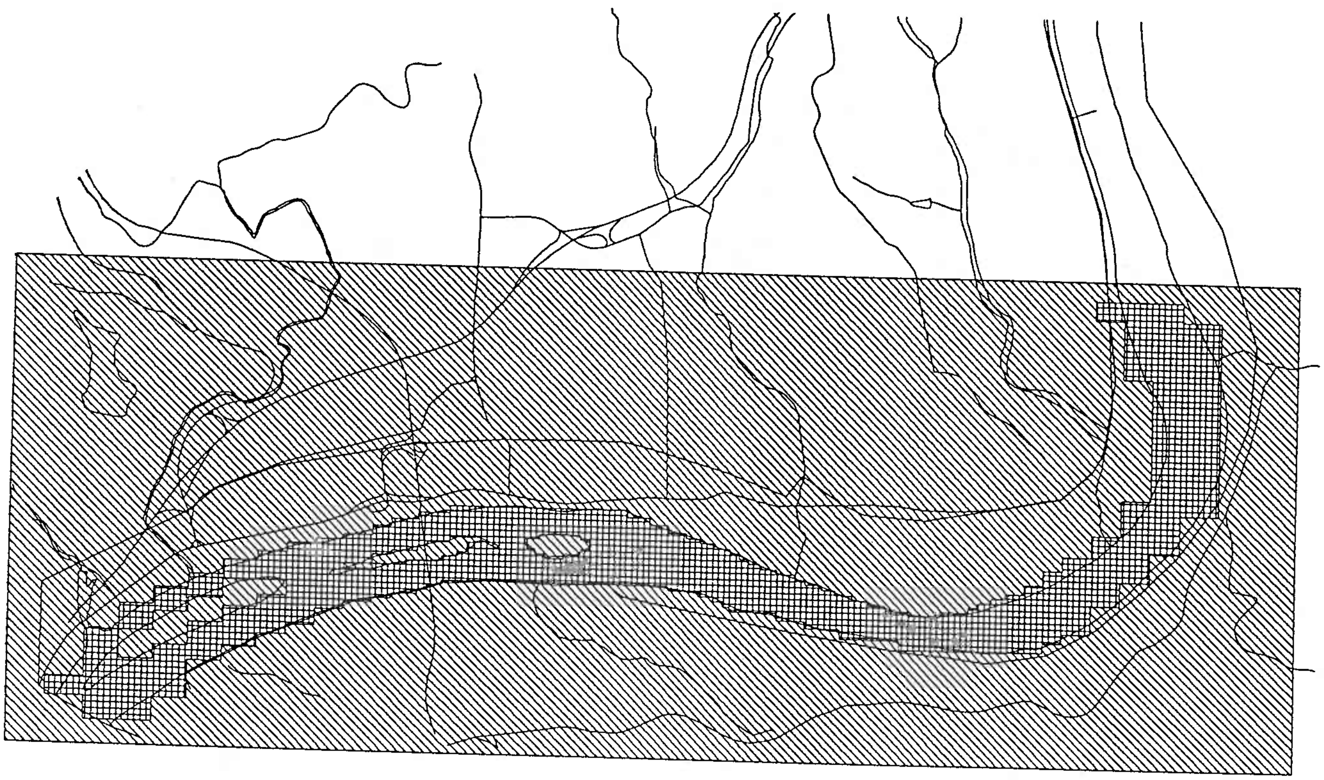


FIGURE 4.1.4

RIVER CELL DESIGNATIONS FOR STUDY AREA CONTAINING SPRINGDALE, CHESWICK AND HARMAR WELL FIELDS



SCALE: 1 inch = 4000 feet

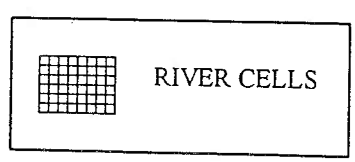
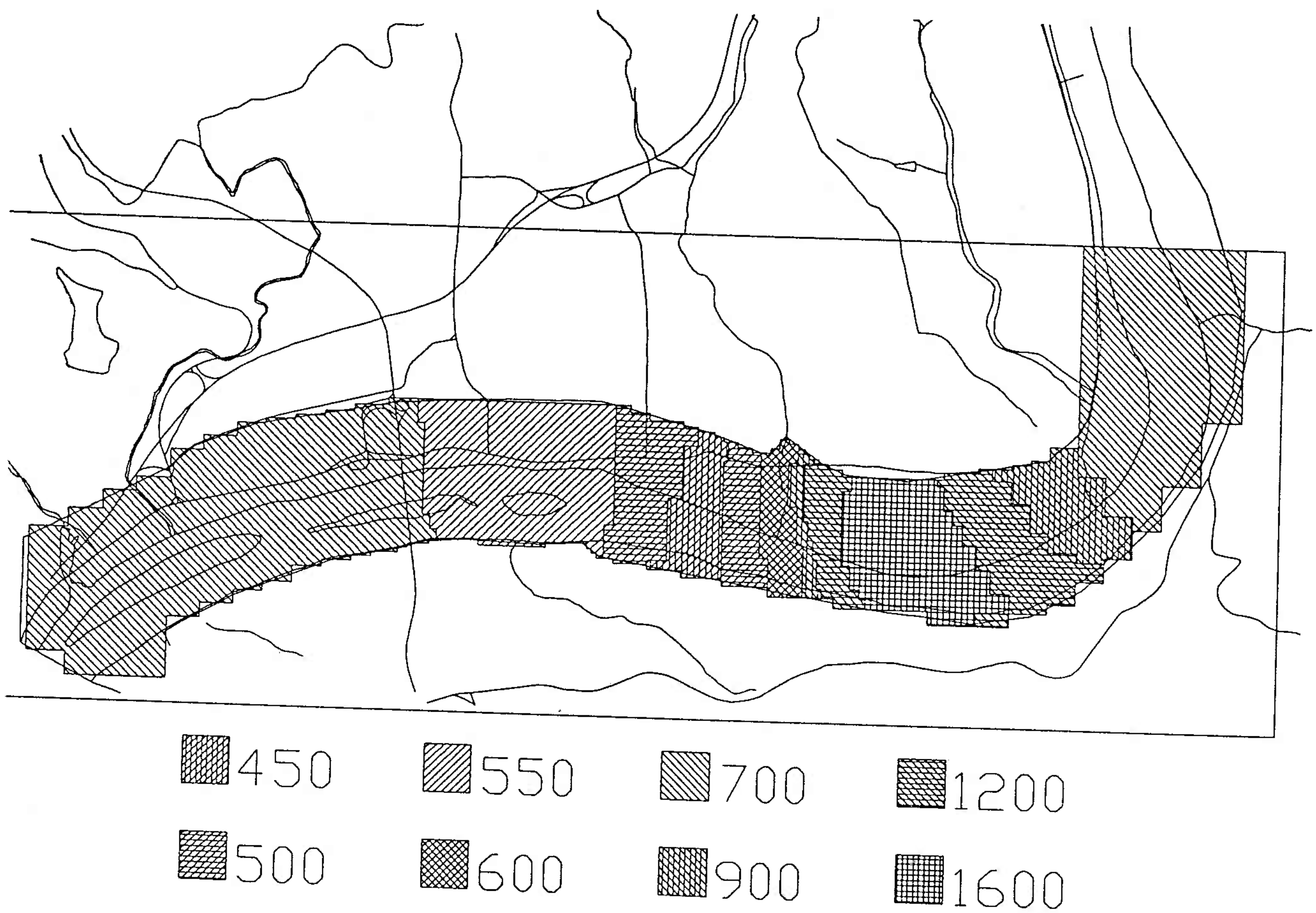


FIGURE 4.1.5

HYDRAULIC CONDUCTIVITIES FOR STUDY AREA CONTAINING SPRINGDALE, CHESWICK AND HARMAR WELL FIELDS

Hydraulic Conductivity in Feet per Day



SCALE: 1 inch = 4000 feet

4.2 Study Area Number 2: Aspinwall, Sharpsburg and Shaler

The conceptual model for the study area including the Aspinwall, Sharpsburg and Shaler well fields consists of one layer, 35 feet thick. The bottom of this layer is at an elevation of 672 feet mean sea level (MSL) at the northeast end of the study area. The layer drops in elevation, southwest across the area to 664 feet MSL at the southwest corner. The river elevation is set at 721 feet MSL above Dam Number 2, and 710 feet MSL below the dam.

The following table lists the pumping rates used in the model construction for the well fields located within the study area. The pumping rates are expressed in gallons per day.

TABLE 4.2.1 PUMPING RATES

Well Field	Location	Pumping Rate
Aspinwall	Borough of Aspinwall	400,000
St. Josephs Paper	Between Aspinwall and Sharpsburg	165,000
Sharpsburg	Borough of Sharpsburg	510,000
Shaler Wells		
Well 1A	Shaler Township	740,000
Well 1	Shaler Township	164,000
Well 2	Shaler Township	82,000
Well 3	Borough of Etna	546,000
Well 4	Borough of Etna	164,000
Well 5	Borough of Etna	246,000
Well 6	Borough of Etna	740,000
Well 7	Borough of Etna	821,000
Well 8	Borough of Etna	369,000
Well 10 (Etna Wellfield)	Borough of Etna	328,000
Well 9 (Etna Wellfield)	Borough of Etna	328,000
Well 8 (Etna Wellfield)	Borough of Etna	246,000
Well 11 (Etna Wellfield)	Borough of Etna	328,000

As shown in TABLE 4.2.1, the combined yield from the Shaler well field is approximately 5.1 million gallons per day.

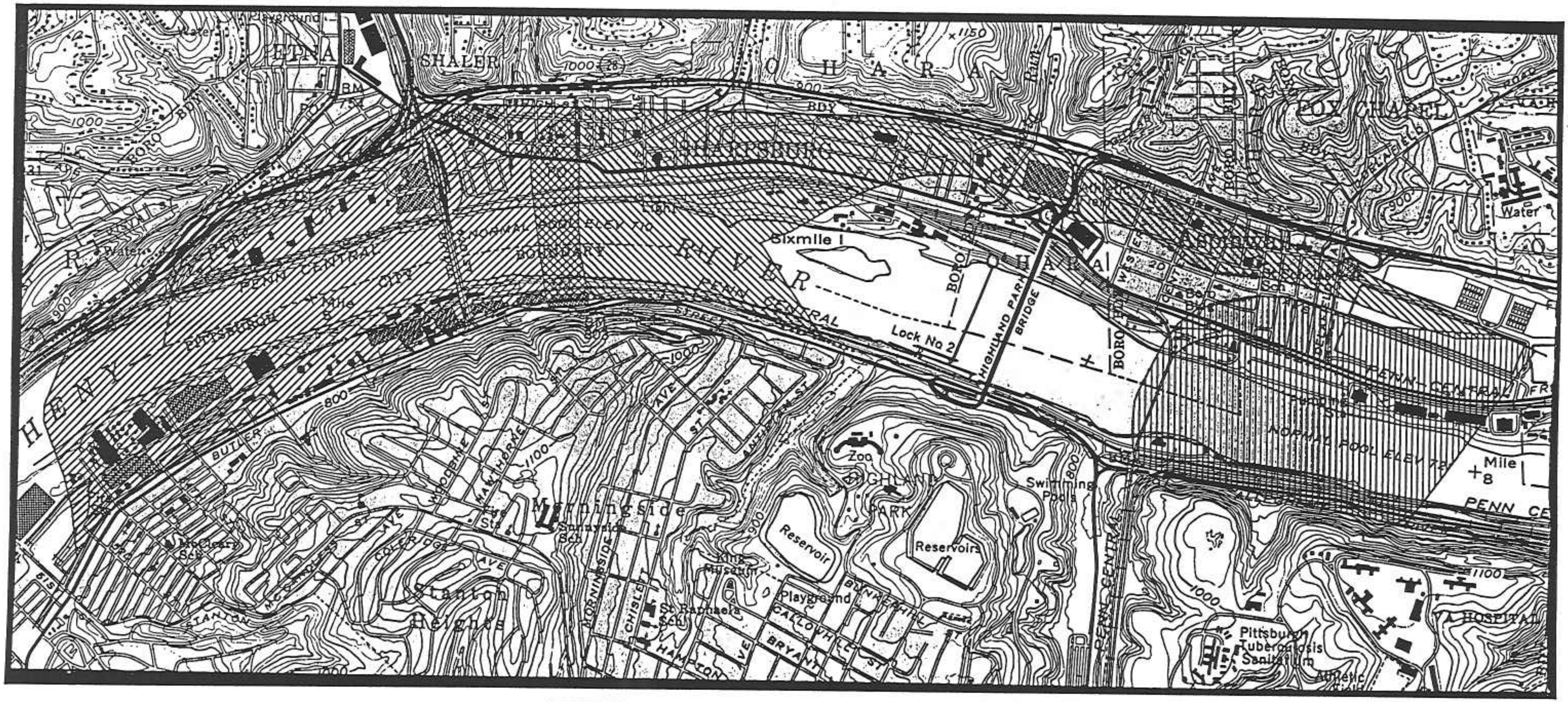
FIGURE 4.2.1 illustrates the calculated capture zones for the three municipal systems included in this study area. Although the industrial St. Josephs Paper well is not displayed in FIGURE 4.2.1, it was assumed to be in operation during the simulation runs. The effect of this well, and the ground water flow around Dam Number 2, accounts for the unusual shapes of the capture zones.

The modeling grid used to construct the numerical model of this study area is shown in FIGURE 4.2.2. The cells within the modeling grid that are specified as active, inactive, and constant head boundary cells are also shown in FIGURE 4.2.2. FIGURE 4.2.3 illustrates the cells that were designated as river cells. The hydraulic conductivities, expressed in feet per day, used in the construction of the numerical model ranged from 100 to 800. The distribution of values used to express the hydraulic conductivity are shown in FIGURE 4.2.4.

The water balance error for the simulation runs of the numerical model for this study area are 0.00%, well below the acceptable range of 0 to 1 percent. The simulated pumping levels for the Aspinwall, Sharpsburg and Shaler wells are within three feet of the observed pumping levels.

FIGURE 4.2.1

CALCULATED CAPTURE ZONES FOR ASPINWALL, SHARPSBURG AND SHALER WELL FIELDS



from Pittsburgh East, PA USGS Quadrangle Map

NORTH

SCALE:
1 inch = 2000 feet

CAPTURE ZONE DELINEATION	
ASPINWALL	
SHARPSBURG	
SHALER	

FIGURE 4.2.2

MODELING GRID WITH ACTIVE AND CONSTANT HEAD BOUNDARY CELLS FOR ASPINWALL, SHARPSBURG, SHALER AND INDUSTRIAL WELL FIELDS

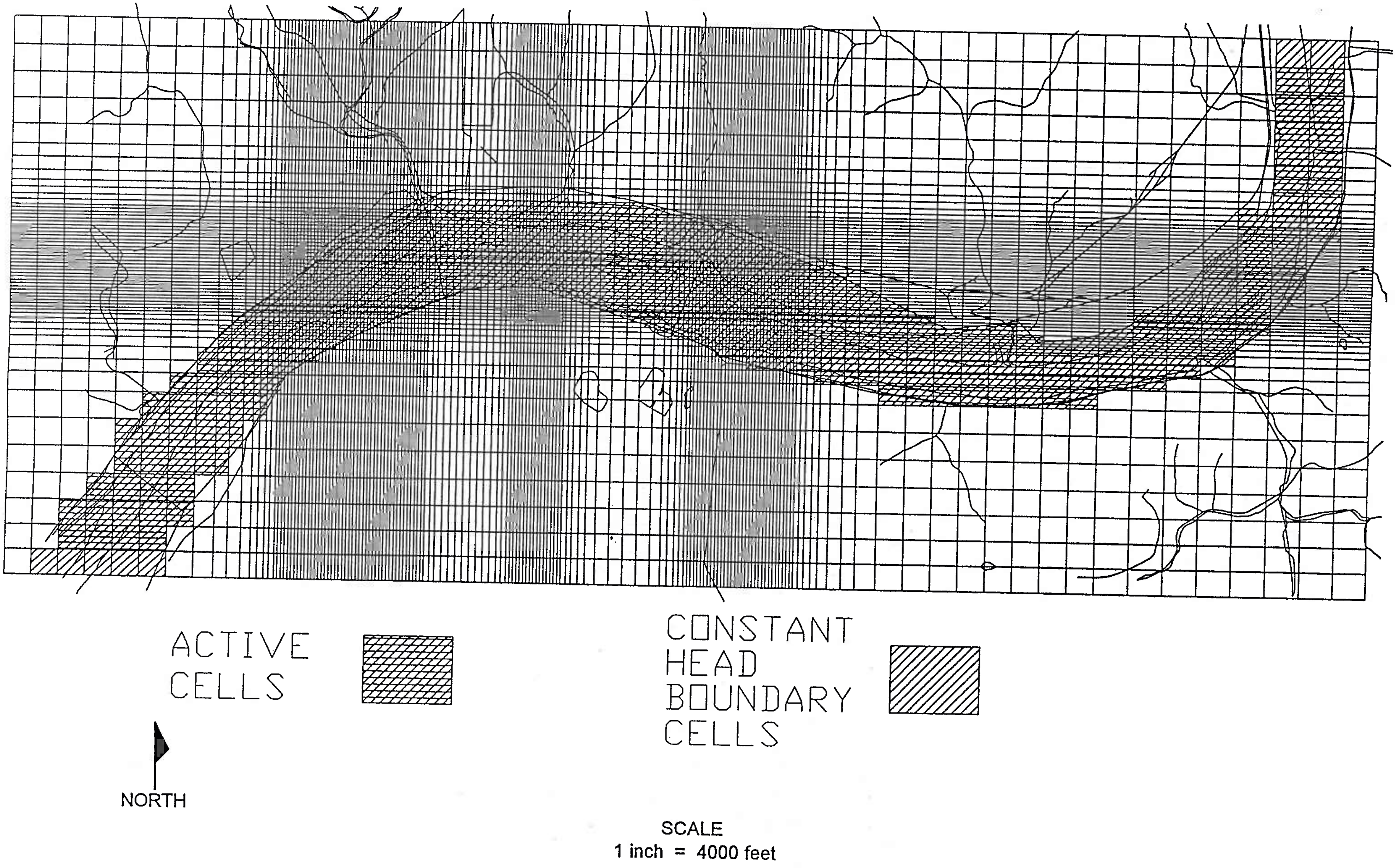
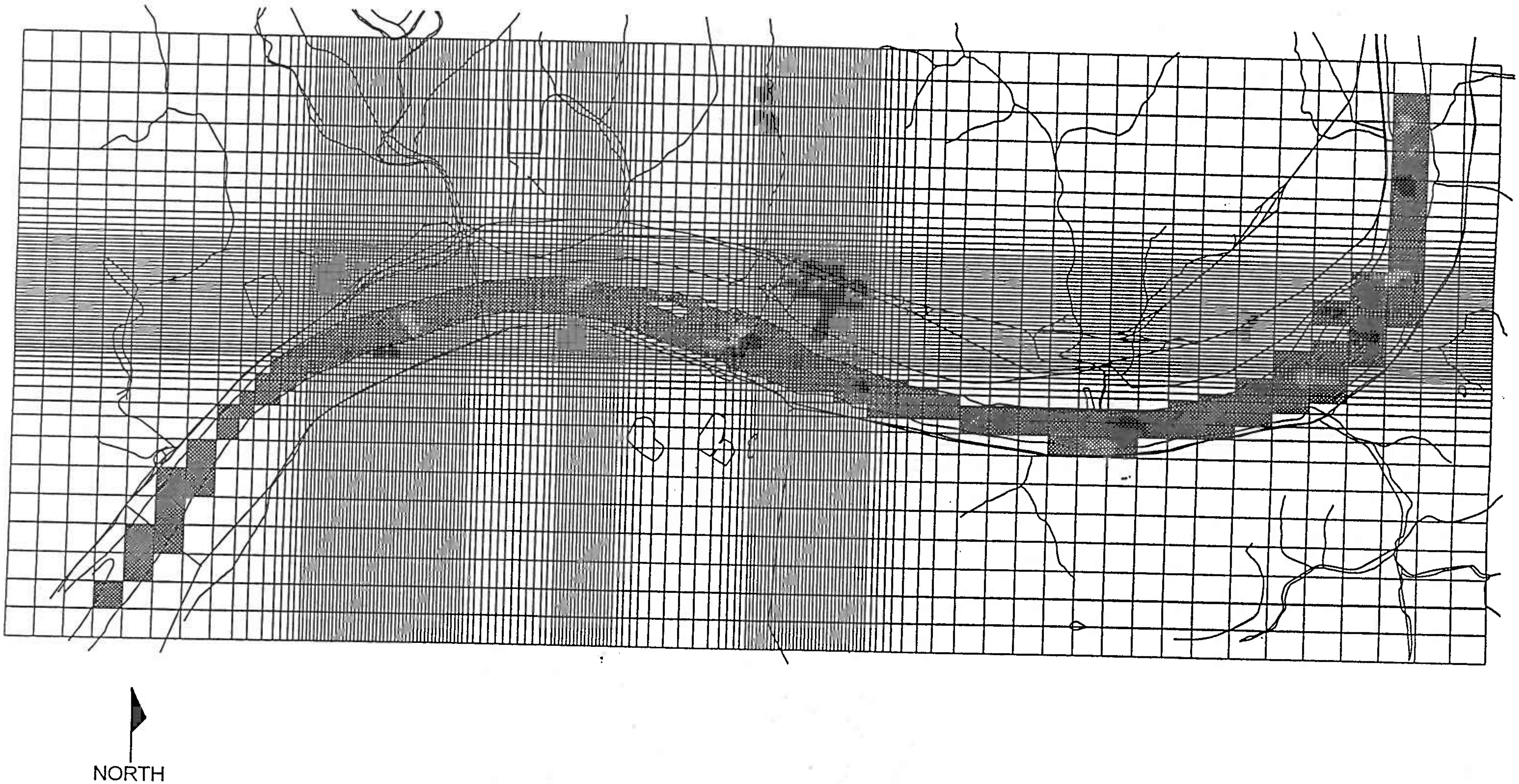


FIGURE 4.2.3

MODELING GRID WITH RIVER CELLS
FOR ASPINWALL, SHARPSBURG, SHALER
AND INDUSTRIAL WELL FIELDS

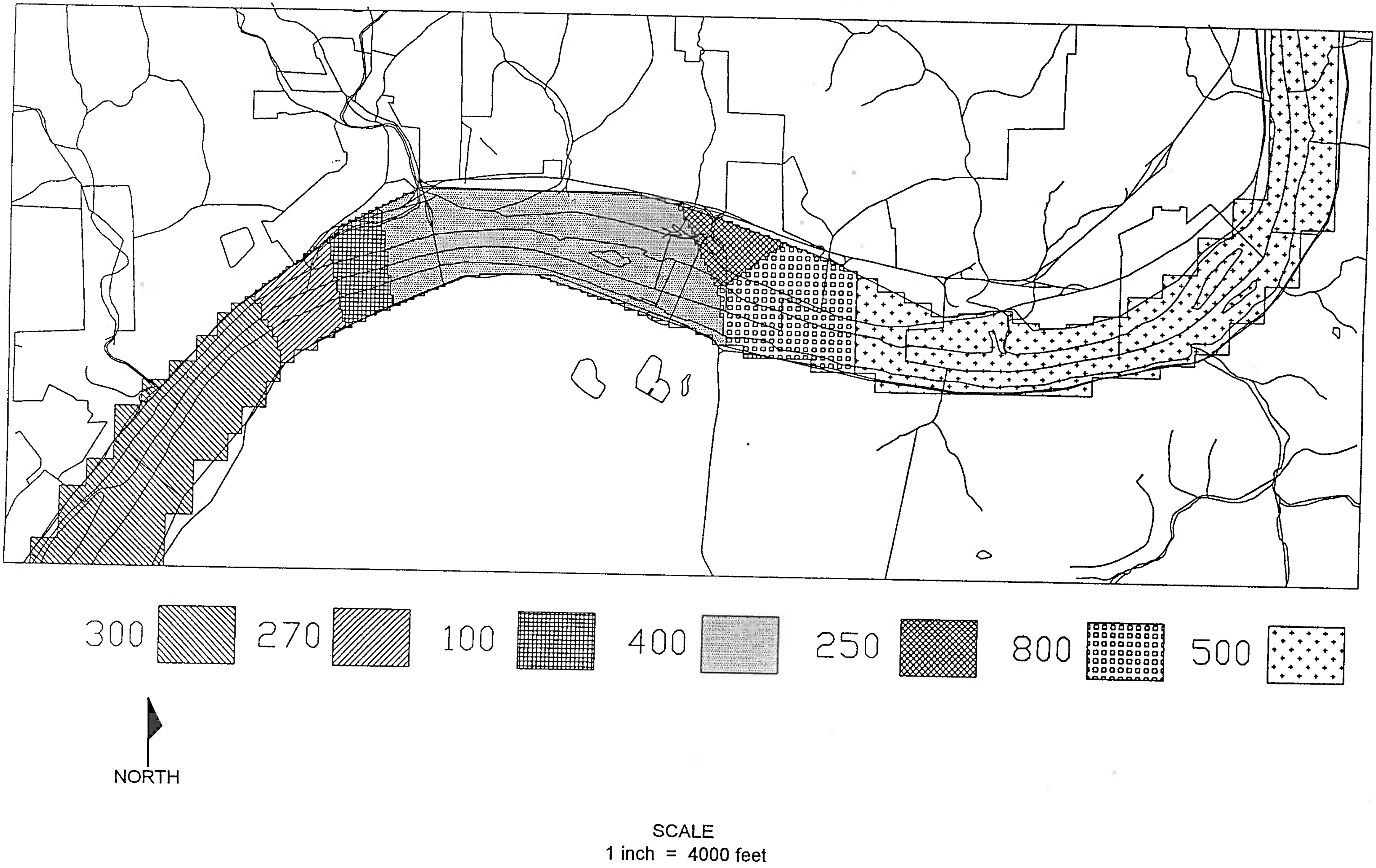


SCALE
1 inch = 4000 feet

FIGURE 4.2.4

ASSUMED HYDRAULIC CONDUCTIVITY VALUES FOR ASPINWALL, SHARPSBURG, SHALER AND INDUSTRIAL WELL FIELDS

Hydraulic Conductivity in Feet per Day



4.3 Study Area Number 3: H. J. Heinz

The conceptual model for the study area including the H. J. Heinz well field consists of one layer, 35 feet thick. The bottom of this layer is at an elevation of 667 feet mean sea level (MSL) at the east end of the study area. The layer drops in elevation, west across the area to 662 feet MSL at the northwest corner. The river elevation is set at 710 feet MSL.

The following table lists the pumping rates used in the model construction for the H. J. Heinz well field located within the study area. The pumping rates are expressed in gallons per day.

TABLE 4.3.1 PUMPING RATES

Well	Location	Pumping Rate
Well 12	North of Allegheny River, near 6th St. Bridge	400,000
Well 11	North of Allegheny River, west of Well 12	285,000
Well 14	South of Allegheny River	343,000
Well 13	South of Allegheny River, west of Well 14	343,000
Well 16	South of Allegheny River, south of Well 13	456,000
Well 17	South of Allegheny River, west of Well 13	572,000
Well 18	South of Allegheny River, southwest of Well 17	687,000
Well 19	South of Allegheny River, west of Well 18	800,000

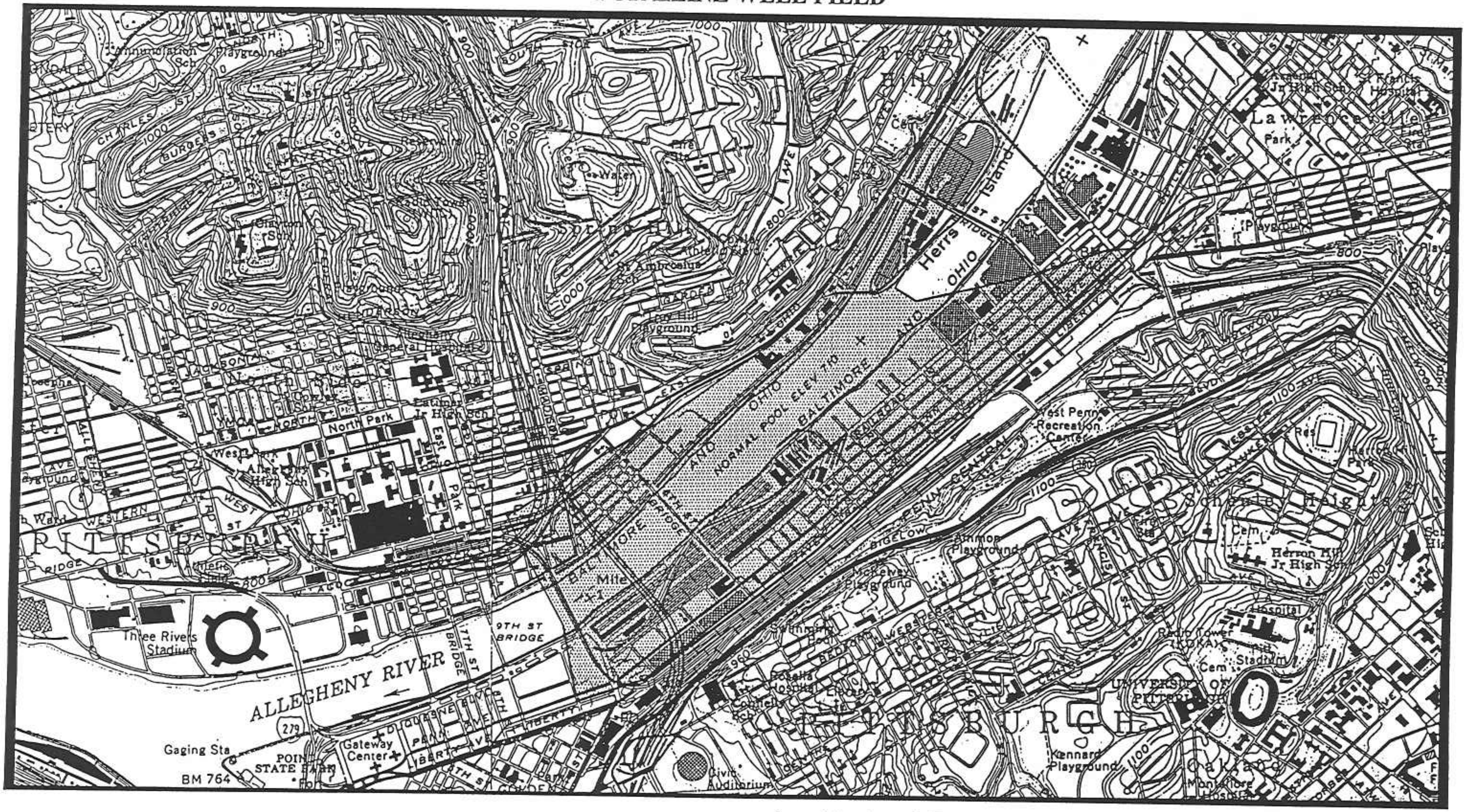
As shown in TABLE 4.3.1, the combined yield from the H. J. Heinz well field is approximately 3.9 million gallons per day.

FIGURE 4.3.1 illustrates the calculated capture zone for the H. J. Heinz system included in this study area. The modeling grid used to construct the numerical model of this study area is shown in FIGURE 4.3.2. The cells within the modeling grid that are specified as active, inactive, and constant head boundary cells are also shown in FIGURE 4.3.3. FIGURE 4.3.4 illustrates the cells that were designated as river cells. The hydraulic conductivities, expressed in feet per day, used in the construction of the numerical model ranged from 100 to 1100. The distribution of values used to express the hydraulic conductivity are shown in FIGURE 4.3.5.

The water balance error for the simulation runs of the numerical model for this study area are 0.00%, well below the acceptable range of 0 to 1 percent. The average simulated pumping levels for the H. J. Heinz wells are within less than one foot of the average observed pumping levels.

FIGURE 4.3.1

CALCULATED CAPTURE ZONE FOR HEINZ WELL FIELD



from Pittsburgh East and Pittsburgh West, Pa USGS Quadrangle Map

CAPTURE ZONE

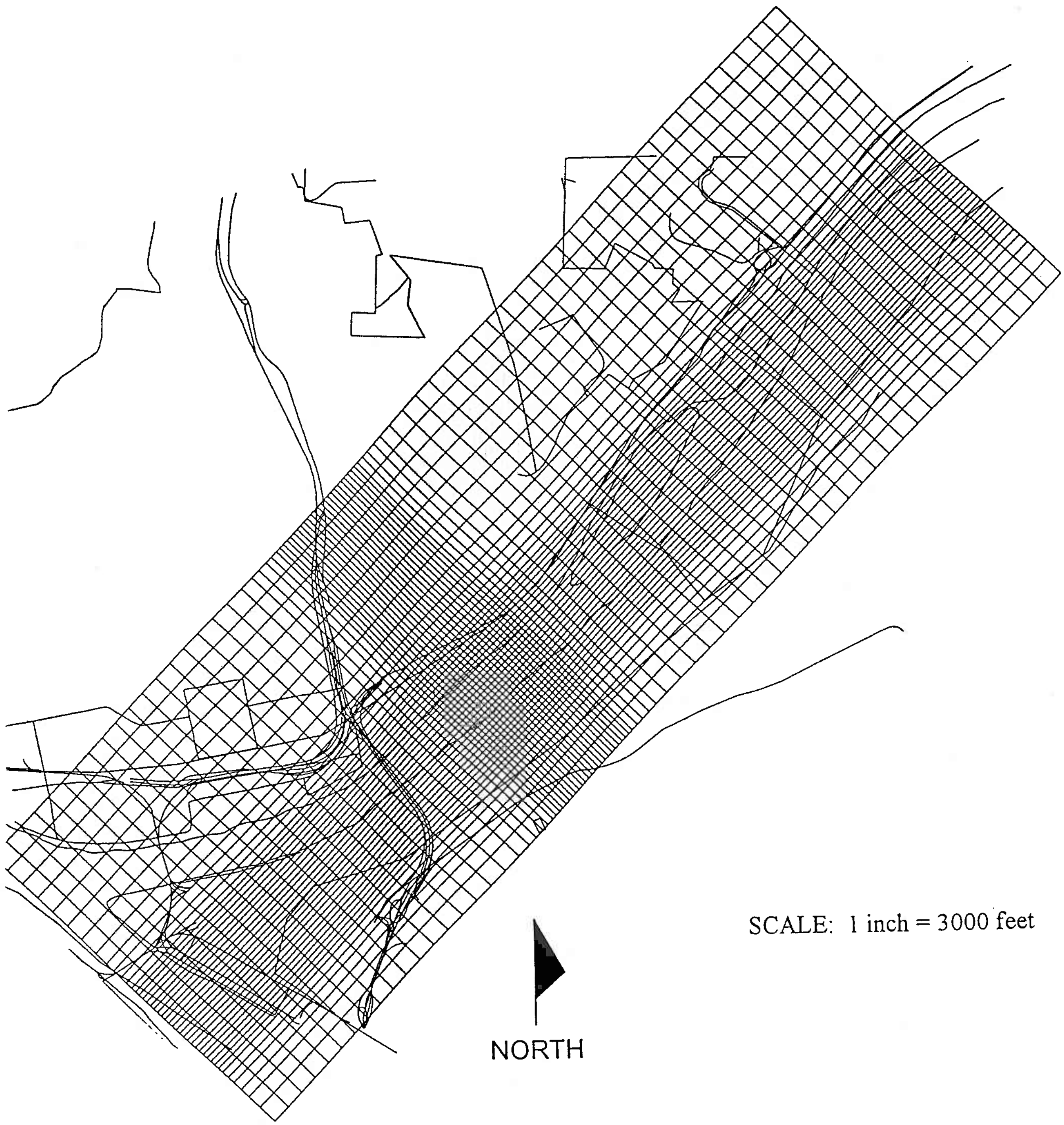
NORTH

SCALE:
1 inch = 2000 feet

Prepared by: Moody and Associates, Inc. - 1995 -

FIGURE 4.3.2

MODELING GRID FOR STUDY AREA CONTAINING
H. J. HEINZ CO. WELL FIELD



SCALE: 1 inch = 3000 feet

FIGURE 4.3.3

CELL DESIGNATIONS FOR STUDY AREA CONTAINING H. J. HEINZ CO. WELL FIELD

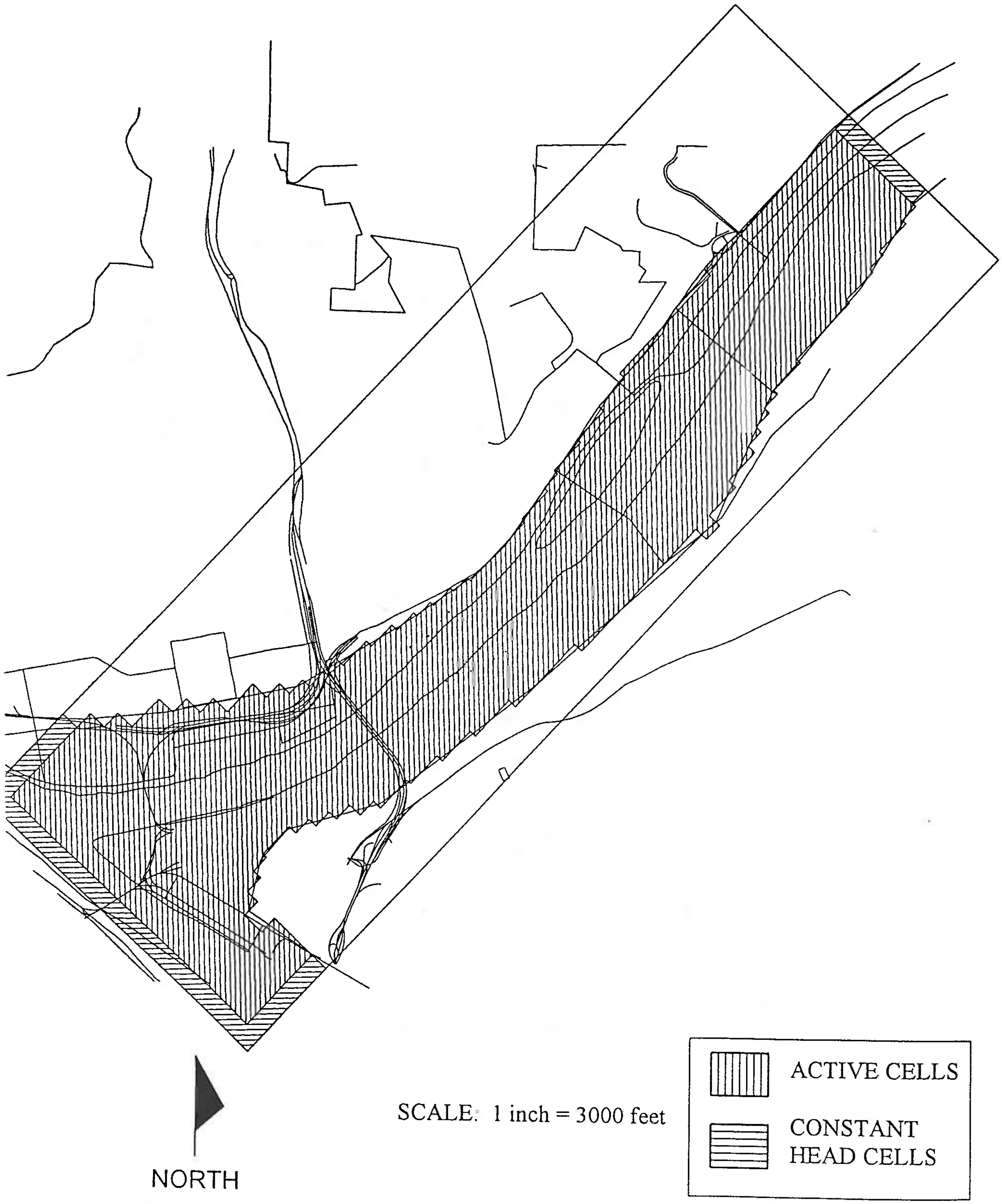


FIGURE 4.3.4

RIVER CELL DESIGNATIONS FOR STUDY AREA CONTAINING H. J. HEINZ CO. WELL FIELD

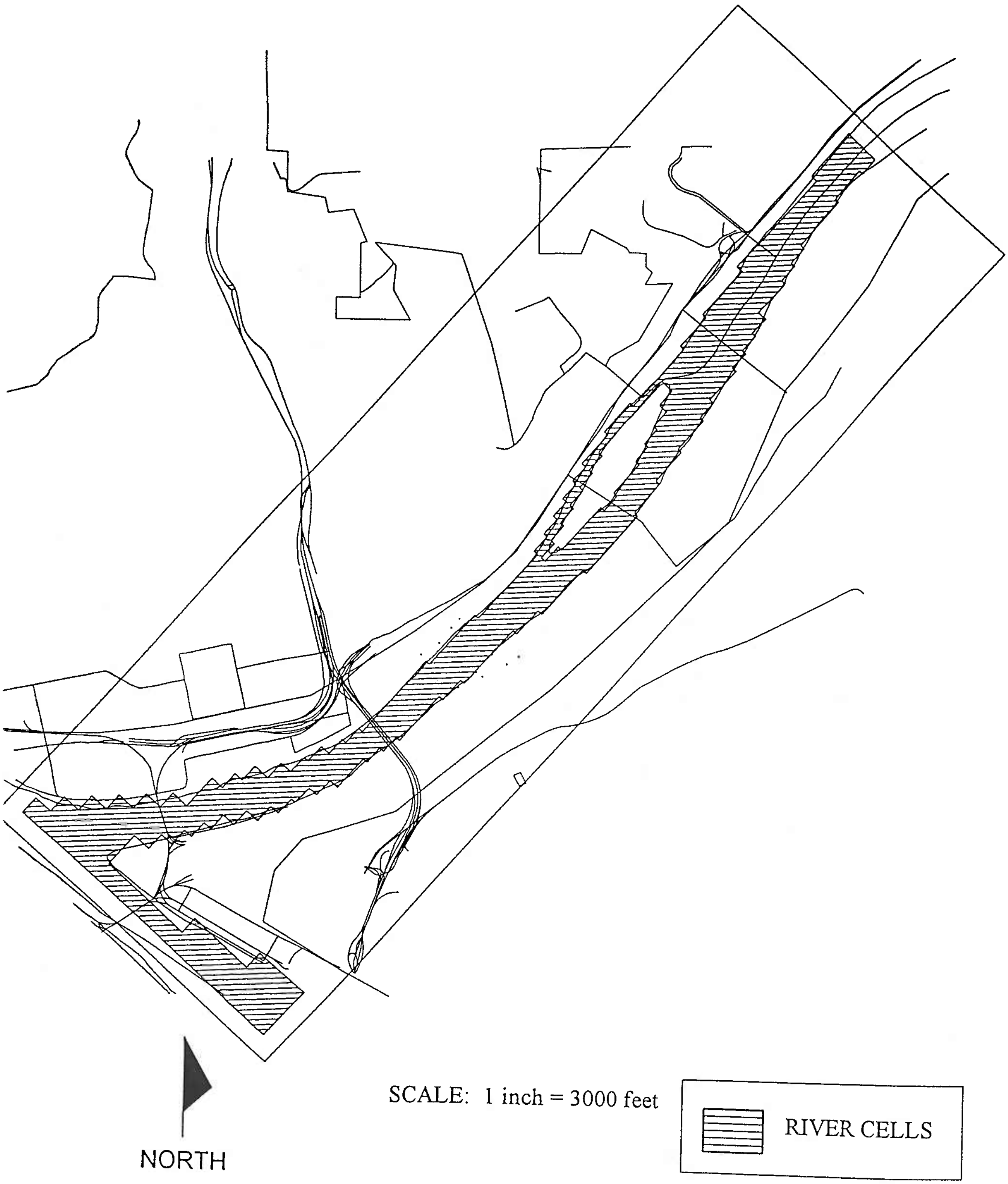


FIGURE 4.3.5

HYDRAULIC CONDUCTIVITIES FOR STUDY AREA CONTAINING H. J. HEINZ CO. WELL FIELD

Hydraulic Conductivities in Feet per Day

4.4 Study Area Number 4: Coraopolis, Moon, Sewickley and Edgeworth

The conceptual model for the study area including the Coraopolis, Moon, Sewickley and Edgeworth well fields consists of one layer, 28 feet thick. The bottom of this layer is at an elevation of 656 feet mean sea level (MSL) at the southeast end of the study area. The layer drops in elevation, northwest across the area to 640 feet MSL at the northwest corner. The river elevation is set at 692 feet MSL above Dashields Dam Number 2, and 682 feet MSL below the dam.

The following table lists the pumping rates used in the model construction for the well fields located within the study area. The pumping rates are expressed in gallons per day.

TABLE 4.4.1 PUMPING RATES

Well Field	Location	Pumping Rate
Coraopolis Well Field	Borough of Coraopolis	
Well 2	Borough of Coraopolis	274,000
Well 6	Borough of Coraopolis	98,000
Well 8	Borough of Coraopolis	274,000
Well 9	Borough of Coraopolis	274,000
Moon Well Field	Moon Township	
Rainey Collector	Moon Township	2,500,000
Well 1	Moon Township	500,000
Well 2	Moon Township	500,000
Sewickley Well Field	Borough of Sewickley	
Well 1	Borough of Sewickley	410,000
Well 2	Borough of Sewickley	410,000
Crib	Borough of Sewickley, in bed of Ohio River	510,000
Edgeworth Well Field	Borough of Edgeworth	870,000

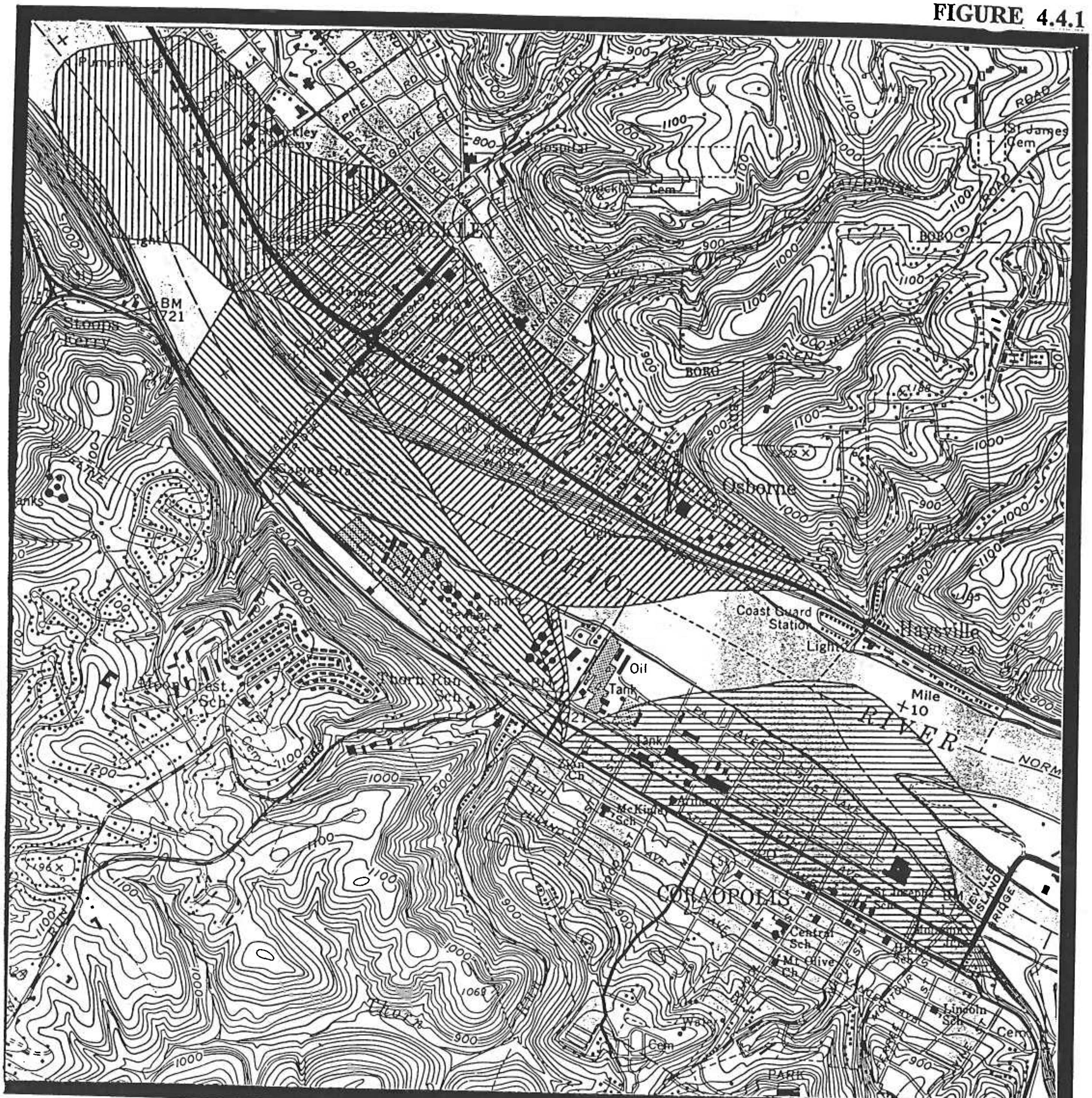
As shown in TABLE 4.4.1, the combined yield from the Coraopolis well field is approximately 0.92 million gallons per day. The combined yield from the Moon Township wells and Rainey Collector is approximately 3.5 million gallons per day. The combined yield for the Sewickley wells and crib is approximately 1.33 million gallons per day.

FIGURE 4.4.1 illustrates the calculated capture zones for the three municipal systems included in this study area.

The modeling grid used to construct the numerical model of this study area is shown in FIGURE 4.4.2. The cells within the modeling grid that are specified as active, inactive, and constant head boundary cells are also shown in FIGURE 4.4.3. FIGURE 4.4.4 illustrates the cells that were designated as river cells. The hydraulic conductivities, expressed in feet per day, used in the construction of the numerical model ranged from 200 to 700. The distribution of values used to express the hydraulic conductivity are shown in FIGURE 4.4.5.

The water balance error for the simulation runs of the numerical model for this study area are 0.01%, well below the acceptable range of 0 to 1 percent. The simulated pumping levels for the Coraopolis, Moon and Sewickley wells are within five feet of the observed pumping levels. Simulated versus observed pumping level comparisons were not possible for the Edgeworth well field. The Edgeworth well field is submerged beneath the Ohio River and is inaccessible.

FIGURE 4.4.1



from Ambridge, PA USGS Quadrangle Map

CALCULATED CAPTURE ZONES FOR EDGEWORTH, SEWICKLEY, MOON AND CORAOPOLIS WELL FIELDS

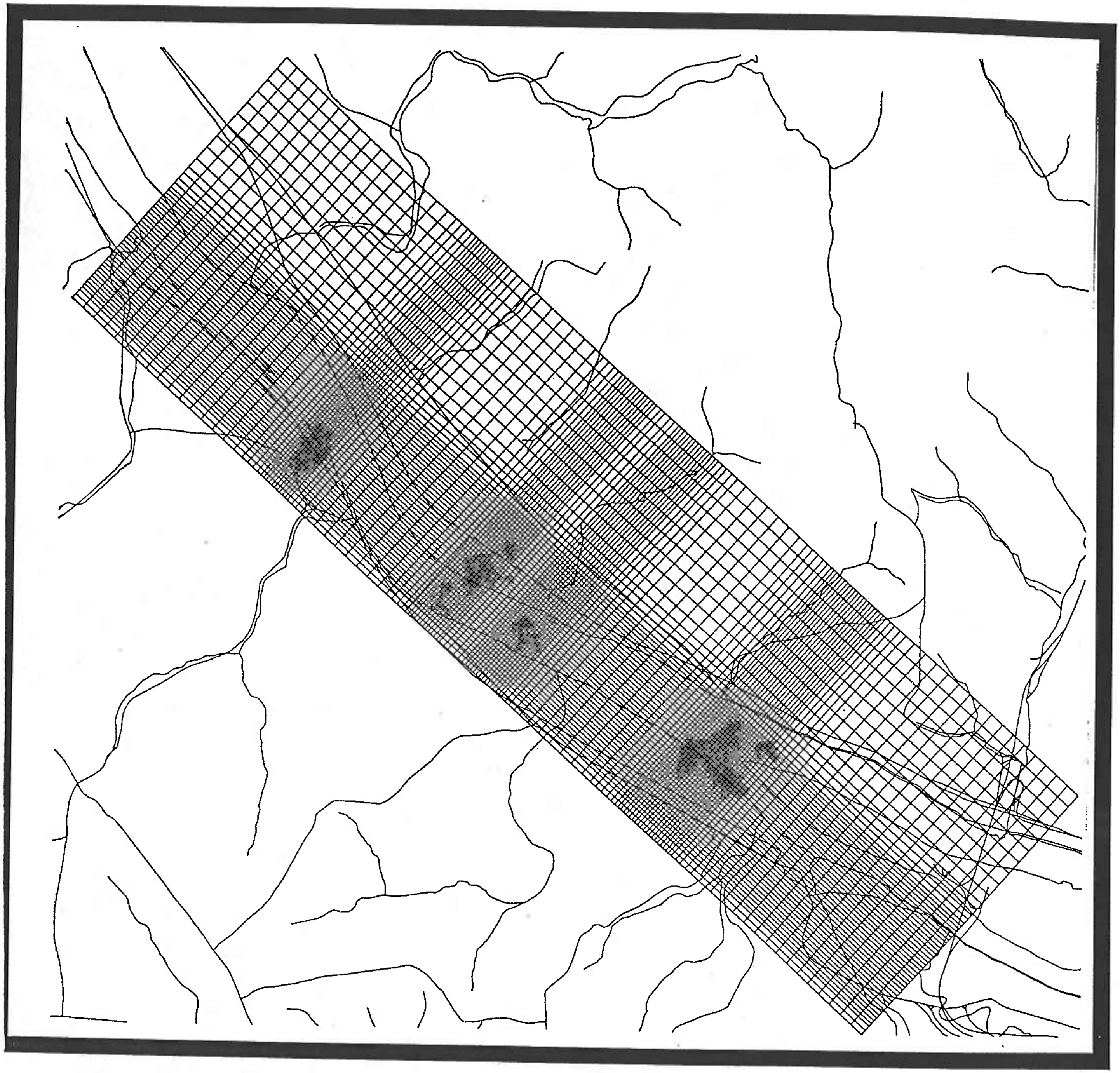
SCALE: 1 inch = 2000 feet

- EDGEWORTH
- SEWICKLEY
- MOON TWP
- CORAOPOLIS

NORTH

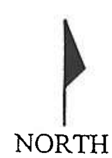
Prepared by: Moody and Associates, Inc. - 1995 -

FIGURE 4.4.2



MODELING GRID FOR STUDY AREA CONTAINING EDGEWORTH, SEWICKLEY, MOON TWP. AND CORAOPOLIS WELL FIELDS

SCALE: 1 inch = 4000 feet



Prepared by: Moody and Associates, Inc. - 1995 -

FIGURE 4.4.3

CELL DESIGNATIONS FOR STUDY AREA CONTAINING EDGEWORTH, SEWICKLEY, MOON TWP. AND CORAOPOLIS WELL FIELDS

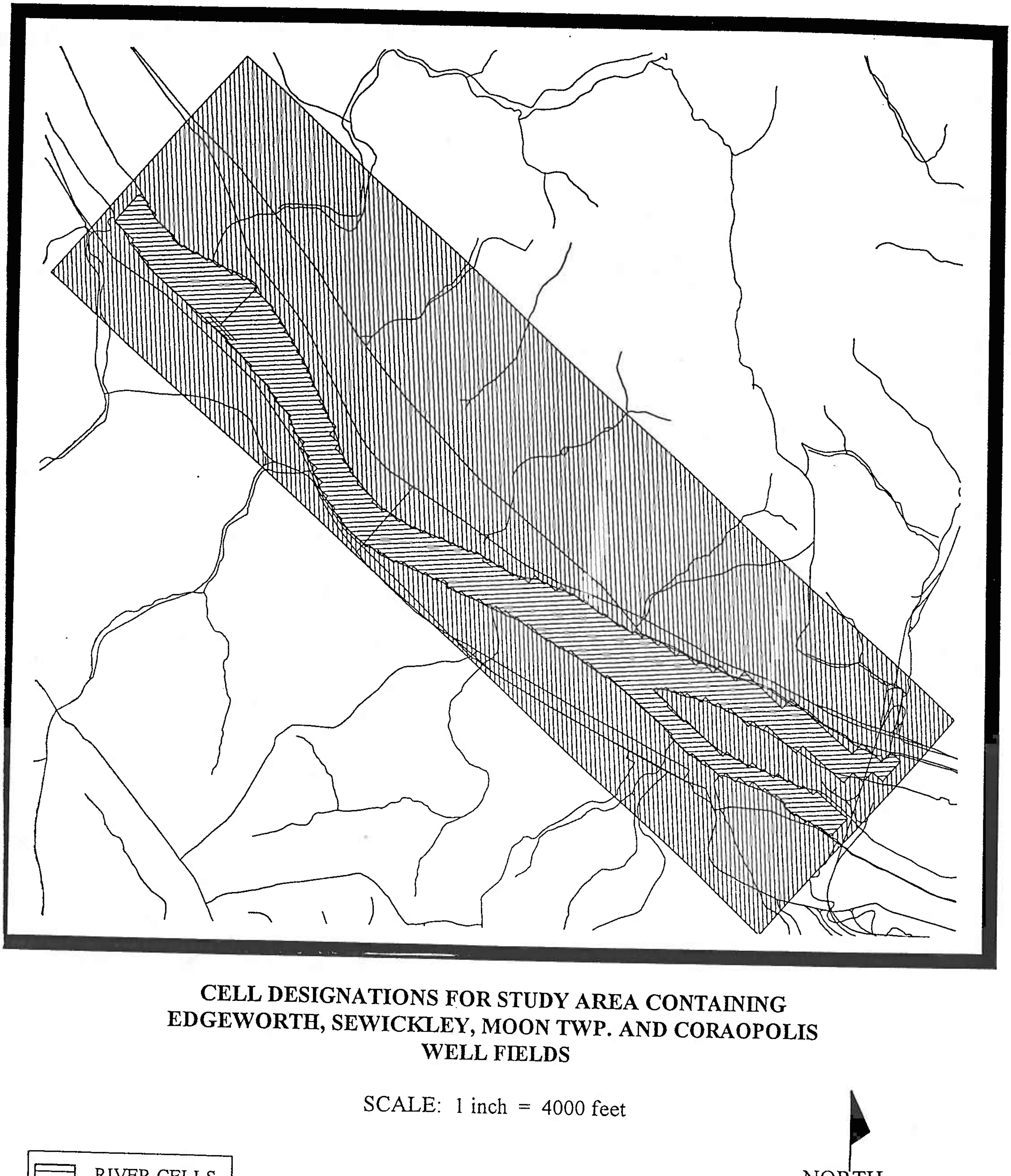
(vertical lines)	INACTIVE CELLS
(diagonal hatch)	ACTIVE CELLS
(horizontal lines)	CONSTANT HEAD CELLS

SCALE: 1 inch = 4000 feet

NORTH

Prepared by: Moody and Associates, Inc. - 1995 -

FIGURE 4.4.4

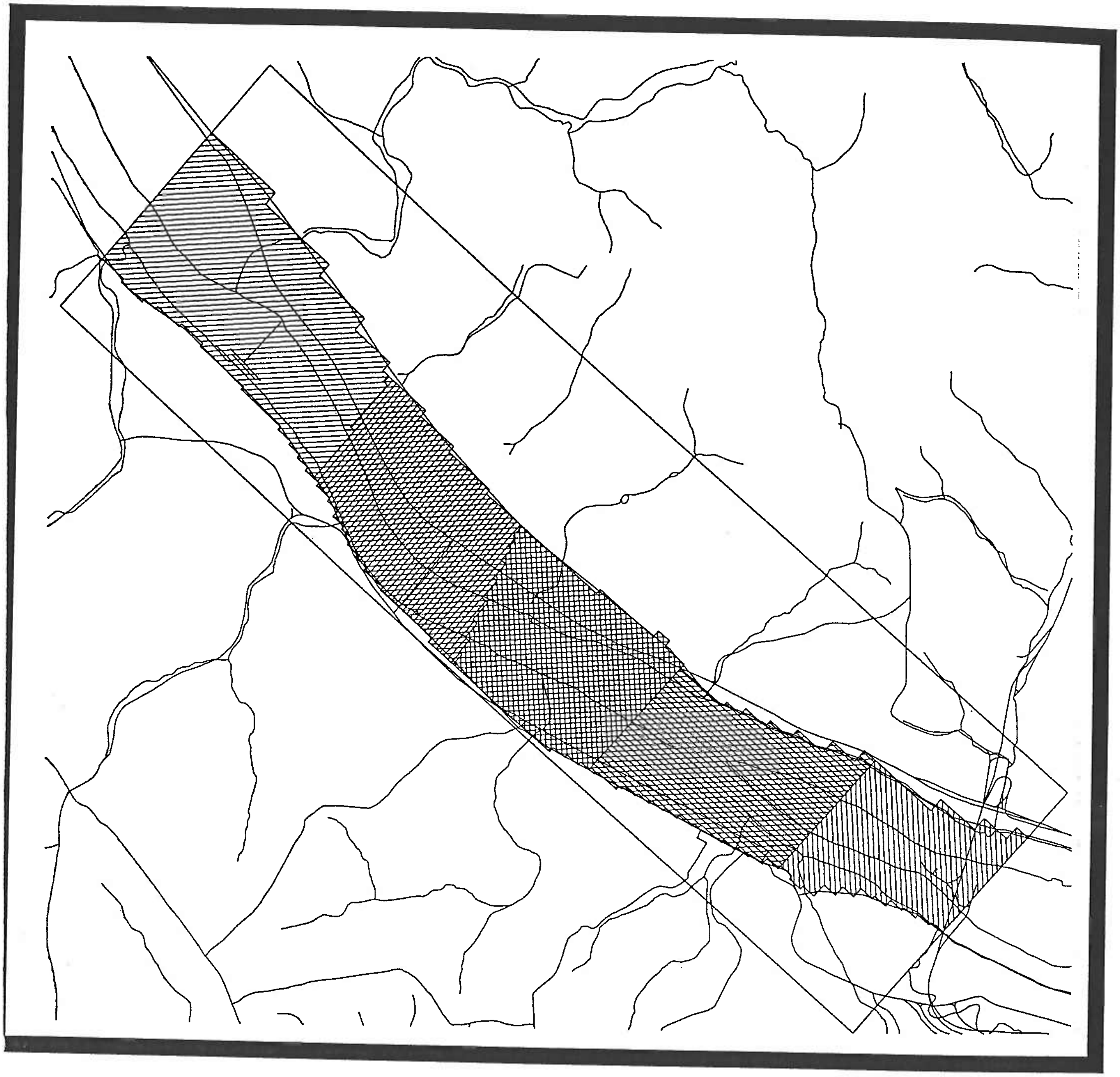


CELL DESIGNATIONS FOR STUDY AREA CONTAINING EDGEWORTH, SEWICKLEY, MOON TWP. AND CORAOPOLIS WELL FIELDS

SCALE: 1 inch = 4000 feet

Prepared by: Moody and Associates, Inc. - 1995 -

FIGURE 4.4.5



HYDRAULIC CONDUCTIVITIES FOR STUDY AREA CONTAINING EDGEWORTH, SEWICKLEY, MOON TWP. AND CORAOPOLIS WELL FIELDS

horizontal lines	500 ft/day
diagonal hatch	700 ft/day
grid	650 ft/day
reverse diagonal hatch	300 ft/day
vertical lines	200 ft/day

SCALE: 1 inch = 4000 feet

NORTH

Prepared by: Moody and Associates, Inc. - 1995 -

5.0 POTENTIAL CONTAMINANT SOURCES

5.1 Methodology

The main underlying principal of wellhead protection programs is that it is much less expensive to protect a ground water resource than it is to try to restore it once it becomes contaminated.

The Allegheny County Health Department (ACHD) began the process of identifying potential contaminant sources in the vicinity of municipal ground water supplies in January 1993. This process began with a cooperative effort between the ACHD, representatives of the individual water systems and the Pennsylvania Rural Water Association (PRWA).

The locations and listings of potential contamination sources within wellhead protection zones or in close proximity are listed and shown in Sections 5.2. These potential contamination sources have been compiled from data, maps, lists and field inspections completed by ACHD, the respective water systems, PRWA and the project consultant.

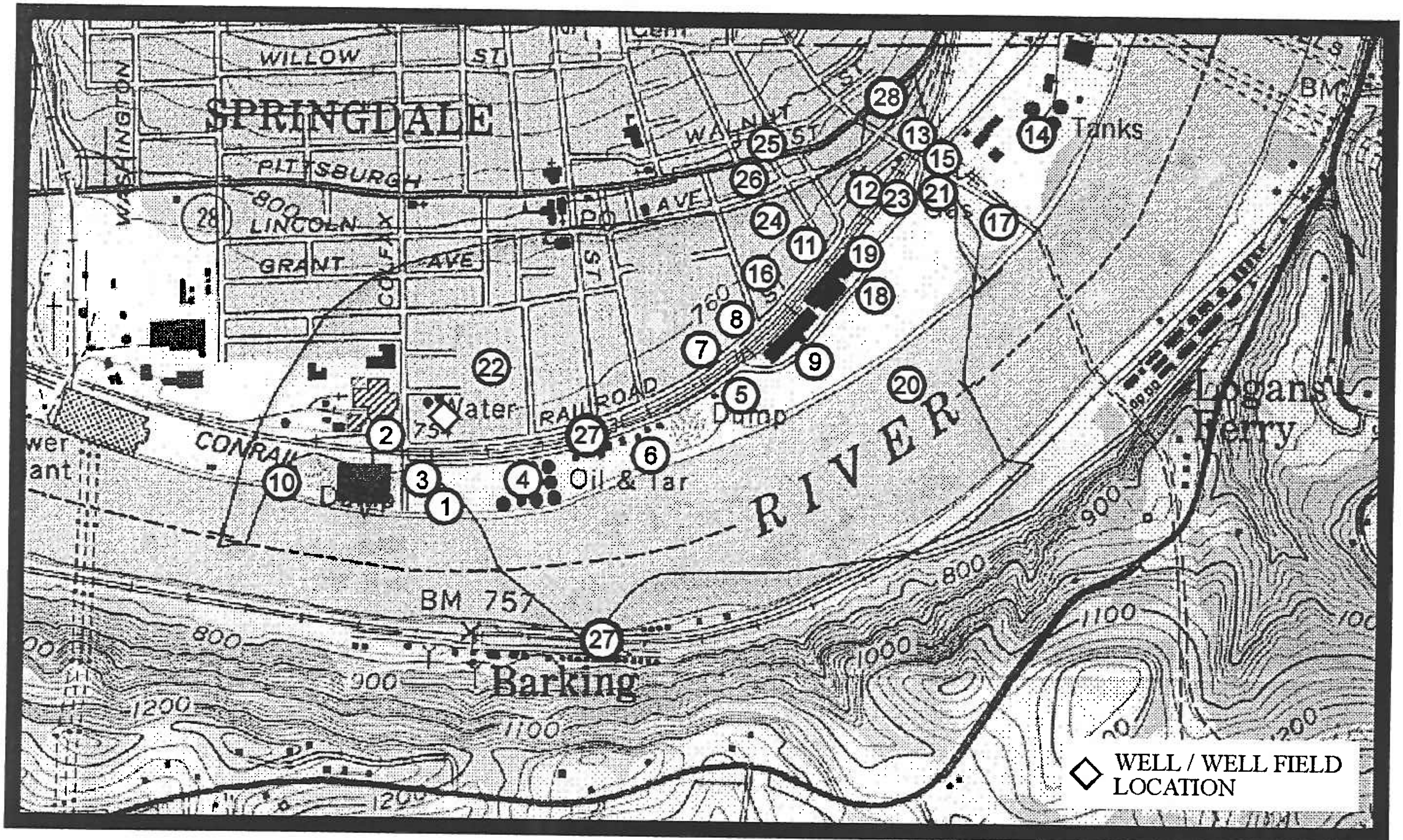
Listing of a current or former facility, business, plant transportation route, etc., does not mean that they are a contamination source, but rather some potential for contamination may exist. Both the water system and each particular entity should be aware of their presence in a wellhead protection area so that appropriate caution and steps can be taken to avoid future contamination.

5.2 Listings and Locations of Potential Sources of Contamination

Borough of Springdale

Potential Sources of Contamination

1. Marine Dump
2. PPG Industries
3. Allegheny Valley Joint Sewage Authority Lift Station
4. United Refining Company Asphalt Group Springdale Terminal
5. Old Scrap Yard/dump
6. Lampus Industries
7. Steinhaus Landscaping
8. Coco Trucking
9. Springdale Specialty Plastics
10. Conrail
11. Techlane Manufacturing
12. Greco
13. Sam's Truck Service
14. West Penn Tank Farm
15. Magnum Metals & Minerals Corp.
16. River City Contracting
17. Laural Pipeline Co.
18. Russell Industries, Inc.
19. Pool City
20. Allegheny River Dredging
21. BJW Holding Company
22. Conviber
23. Sherosky & Butler Street-Parking Area
24. Molnar Heating
25. JMD Gas Station
26. Lot formerly Smitty's Gas Station
27. Railroad Transportation
28. Highway Transportation



from New Kensington West, PA USGS Quadrangle

NORTH

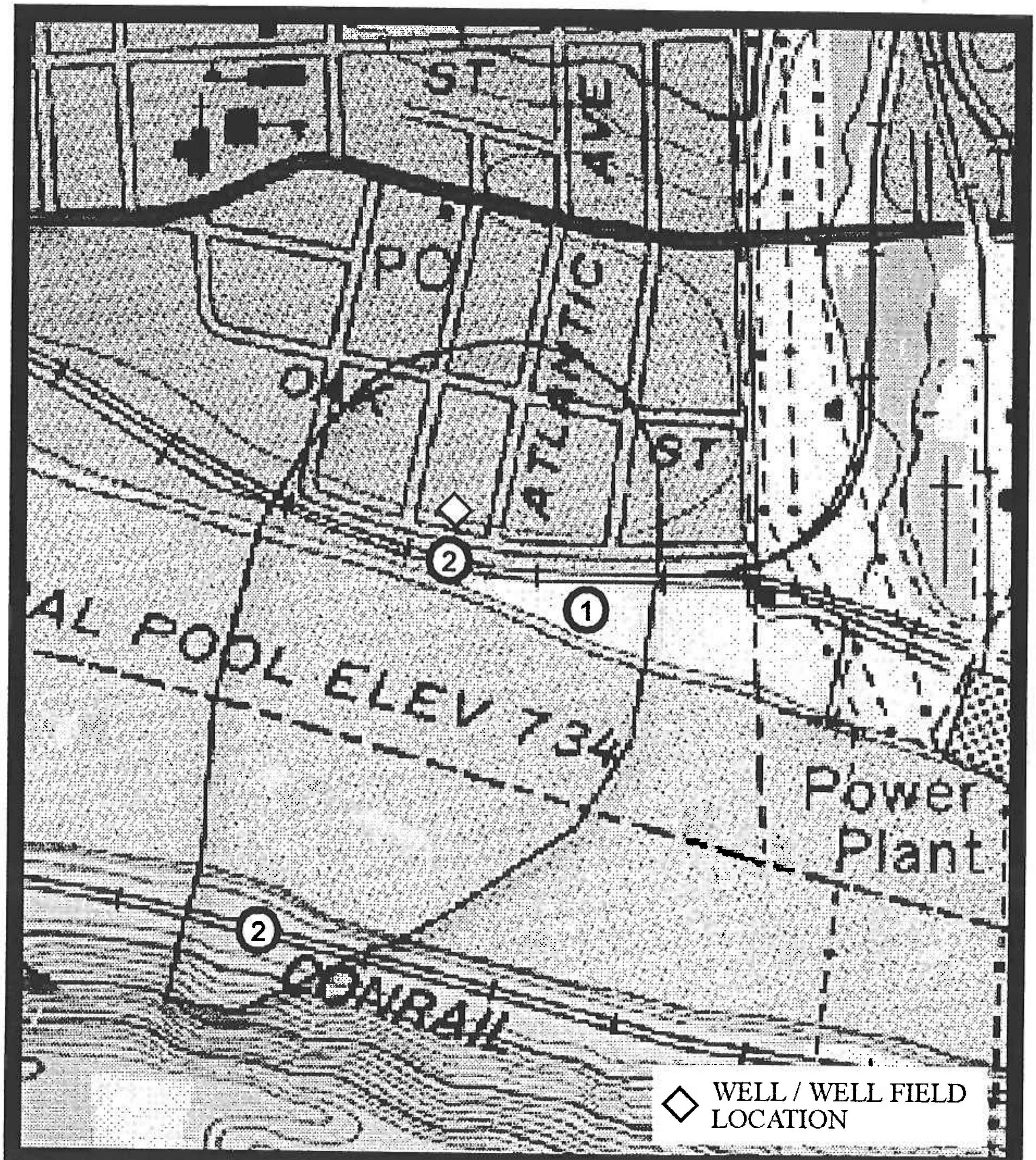
SPRINGDALE POTENTIAL CONTAMINANT SOURCE INVENTORY MAP

SCALE: 1 inch = 1000 feet

Borough of Cheswick

Potential Sources of Contamination

1. Pressure Sewer Line
2. Rail Lines



from New Kensington West, PA USGS Quadrangle

CHESWICK POTENTIAL CONTAMINANT SOURCE INVENTORY LOCATION MAP

NORTH

SCALE: 1 inch = 500 feet

Municipal Authority of the
Township of Harmar

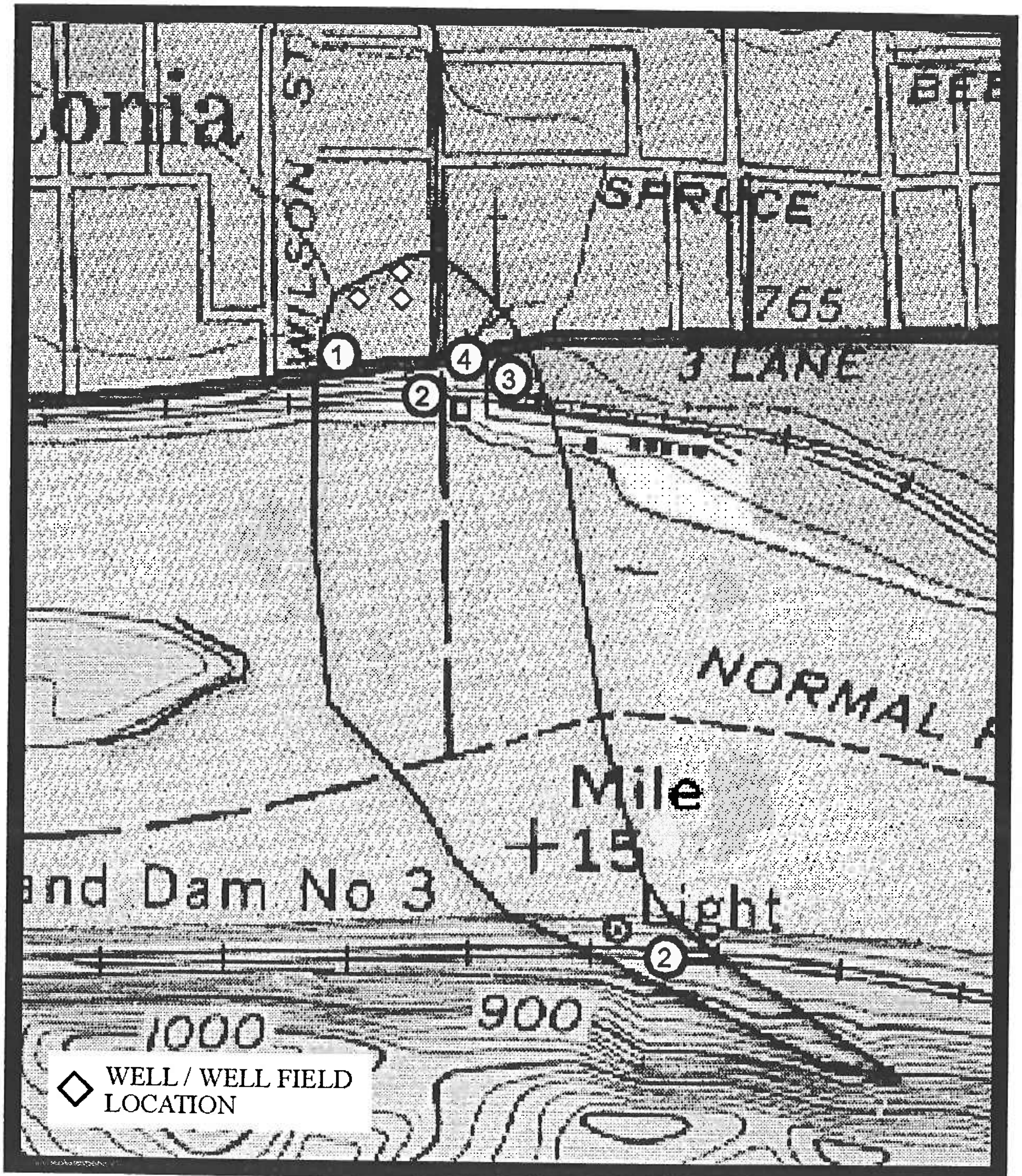
Potential Sources of Contamination

1. Diesel Injection Repair Company

2. Railroad

3. Pressure Sewer Line

4. Highway Transportation



from New Kensington West, PA USGS Quadrangle

HARMAR POTENTIAL CONTAMINANT SOURCE INVENTORY LOCATION MAP

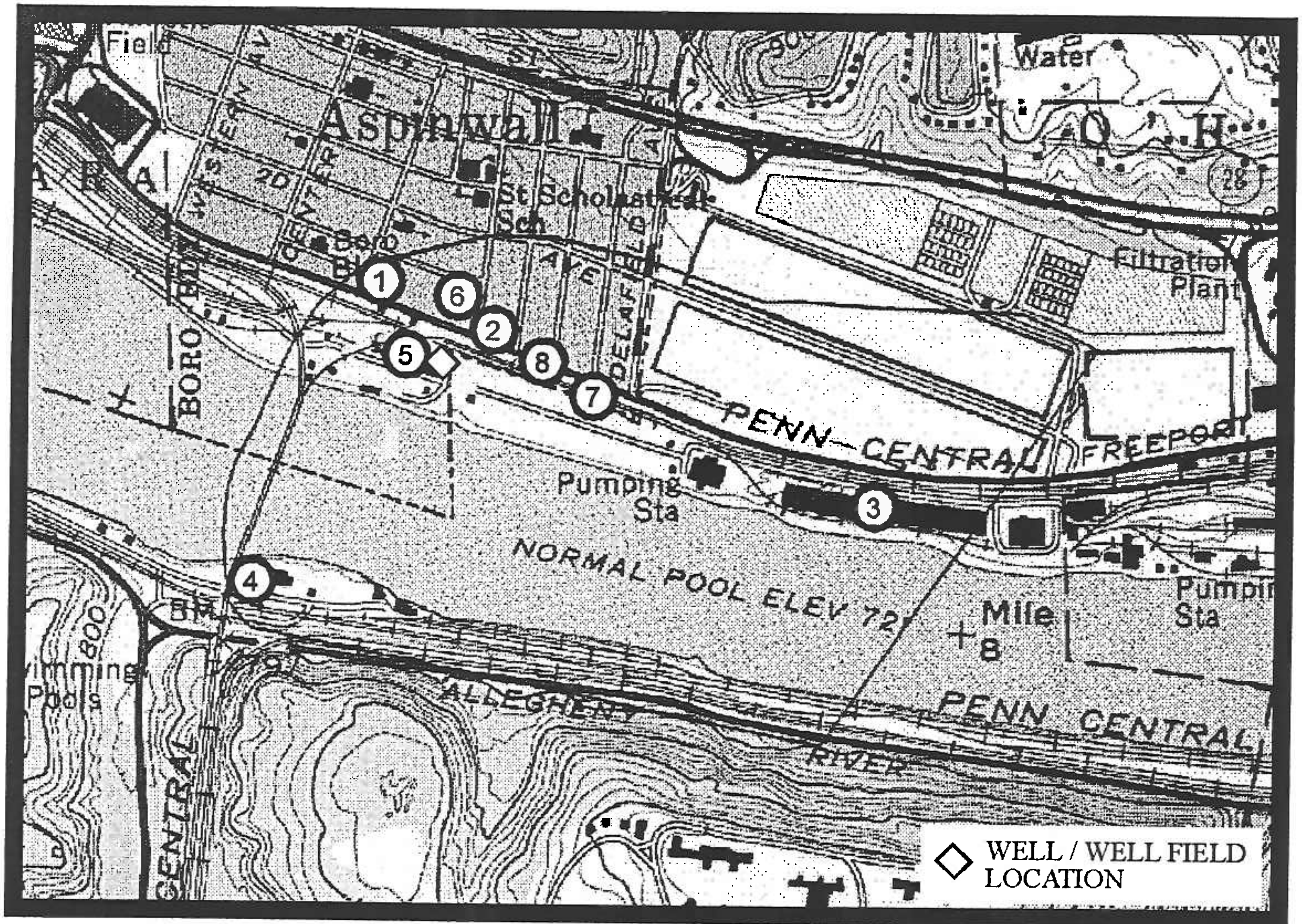
NORTH

SCALE: 1 inch = 500 feet

Borough of Aspinwall

Potential Sources of Contamination

1. Gas Station
2. Printing Shop
3. City of Pittsburgh Water Treatment Plant
4. Asphalt Plant
5. Marina - UST's
6. Road Salt Storage
7. Railroad Transportation
8. Highway Transportation



from Pittsburgh East, PA USGS Quadrangle

ASPINWALL POTENTIAL CONTAMINANT SOURCE INVENTORY MAP

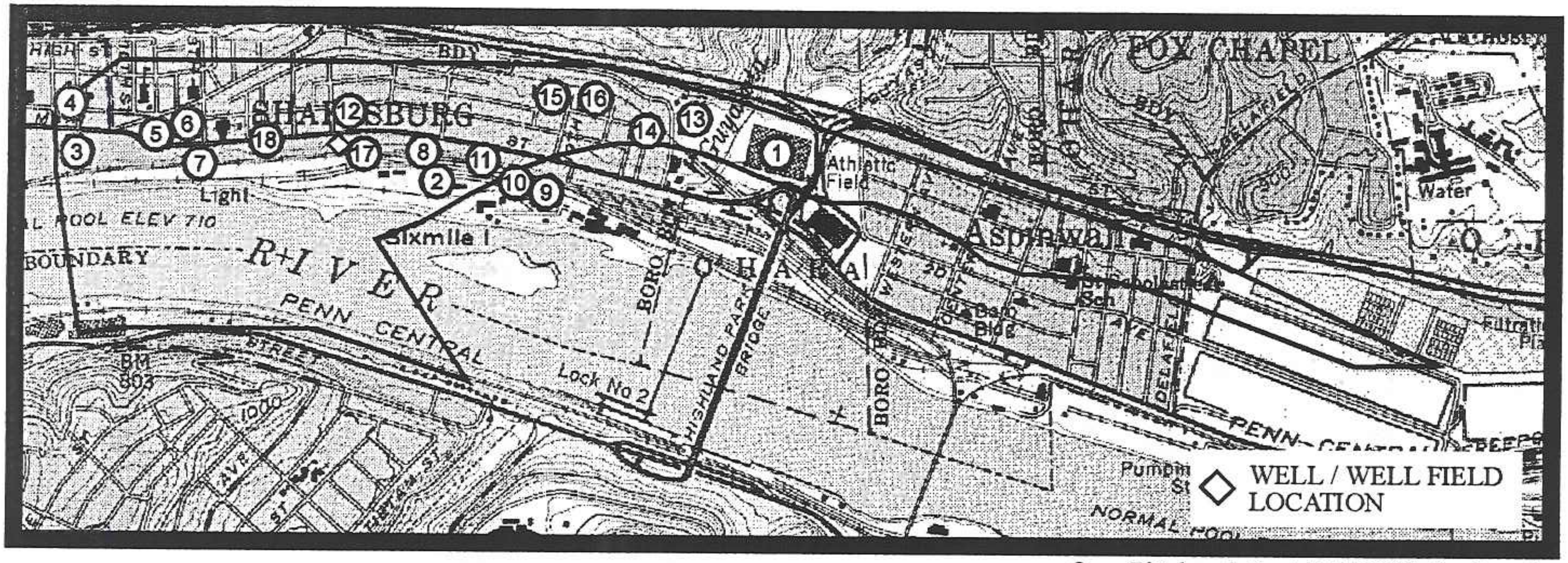
NORTH

SCALE: 1 inch = 1000 feet

Borough of Sharpsburg

Potential Sources of Contamination

1. St. Joe Paper Company
2. Scrapyard
3. Henry Miller Spring Company
4. Photo Lab
5. DPW-Sharpsburg
6. Car Service Garage
7. Auto Service/Auto Body
8. Texaco Gas Station
9. Marina
10. Roc-Built; Tool Shop
11. Flint Ink Company
12. Truck Repair Garage
13. Globe Electric Repair
14. Richland Machine Products
15. Pittsburgh Metal Processing
16. Engineered Flooring Systems
17. Railroad Transportation
18. Highway Transportation



from Pittsburgh East, PA USGS Quadrangle

NORTH

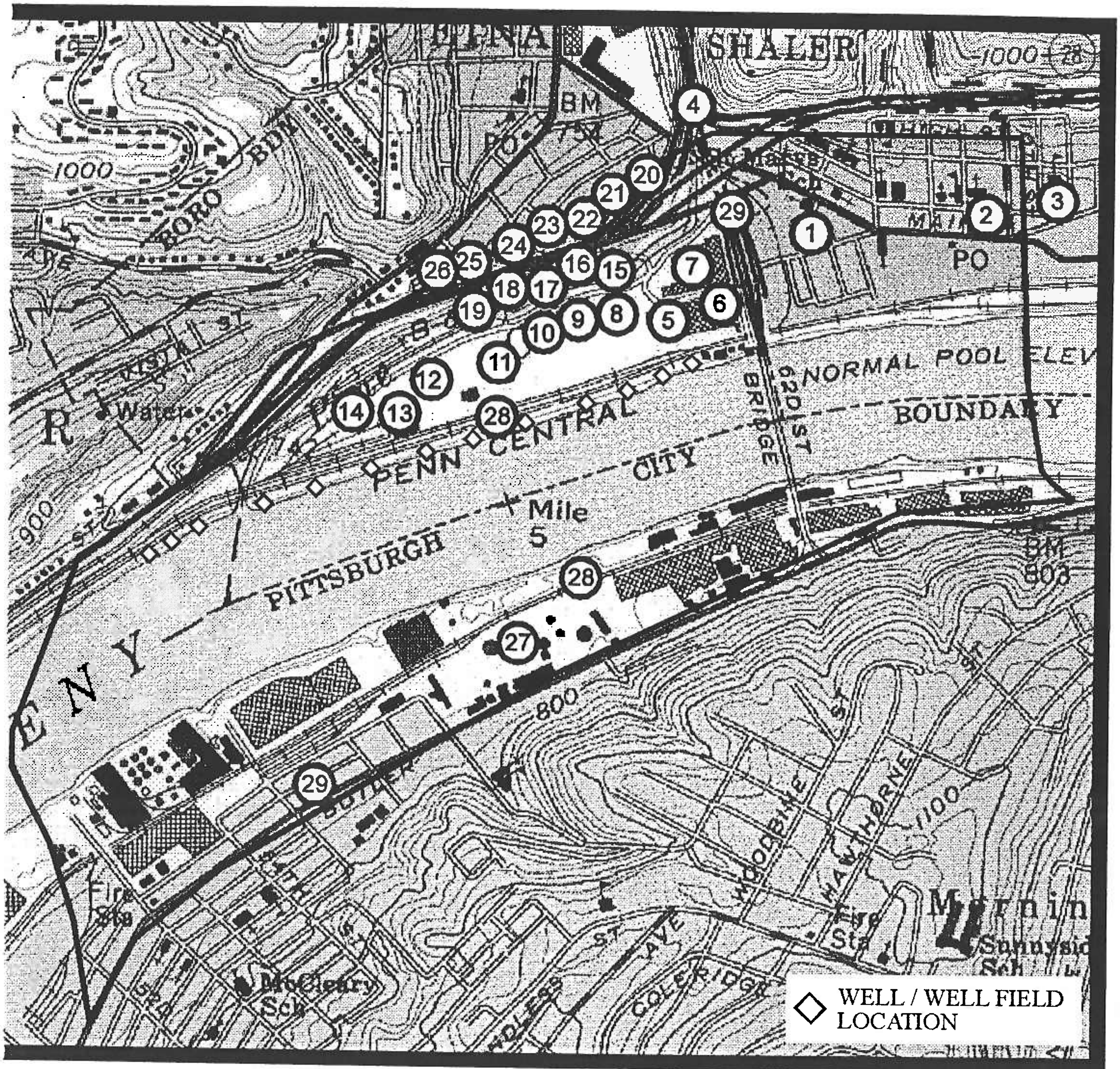
SHARPSBURG POTENTIAL CONTAMINANT SOURCE INVENTORY MAP

SCALE: 1 inch = 1500 feet

Township of Shaler

Potential Sources of Contamination

1. Puritan Paint & Oil Company
2. Henry Miller Springs
3. St. Joe Container Company
4. Ranbar Technology Company
5. Voegele & Extech
6. Pro Steel Industries
7. Wright Industries
8. Preton Trucking
9. Huckenstein Inc.
10. Reno Trucking Sales
11. Alumna-Systems
12. Action Transit
13. General Car & Truck
14. Stockham Valves & Fitting
15. Monohan Associates
16. ABCO Tool's & Supply
17. E.C.S.I.
18. Valve Systems
19. Coupling Systems
20. Break-N-Eat
21. I.C.I. Industries
22. Hickman-Williams
23. Staple Supply
24. Etna Auto Works
25. Thomas Metals
26. Anderson Welding
27. Industrial/Commercial Development South of Allegheny River
28. Railroad Transportation
29. Highway Transportation



from Pittsburgh East, PA USGS Quadrangle

SHALER POTENTIAL CONTAMINANT SOURCE INVENTORY MAP

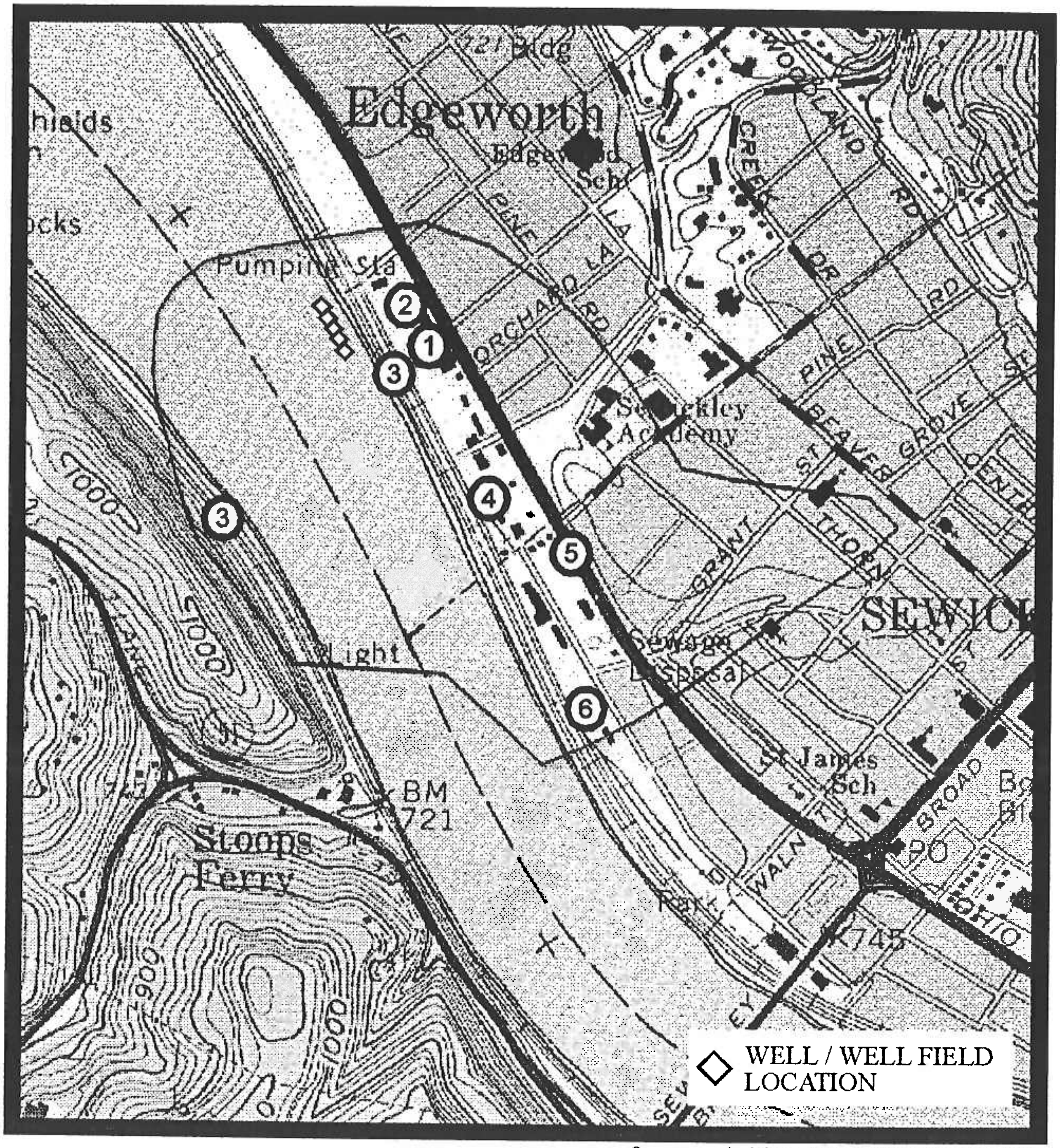
SCALE: 1 inch = 1000 feet

NORTH

Municipal Authority of the
Borough of Edgeworth

Potential Sources of Contamination

1. Gasoline Service Station
2. Medical Center
3. Railroad Transportation
4. Truck Terminal
5. Highway Transportation
6. Salt Pile Storage



from Ambridge, PA USGS Quadrangle

EDGEWORTH POTENTIAL CONTAMINANT SOURCE INVENTORY MAP

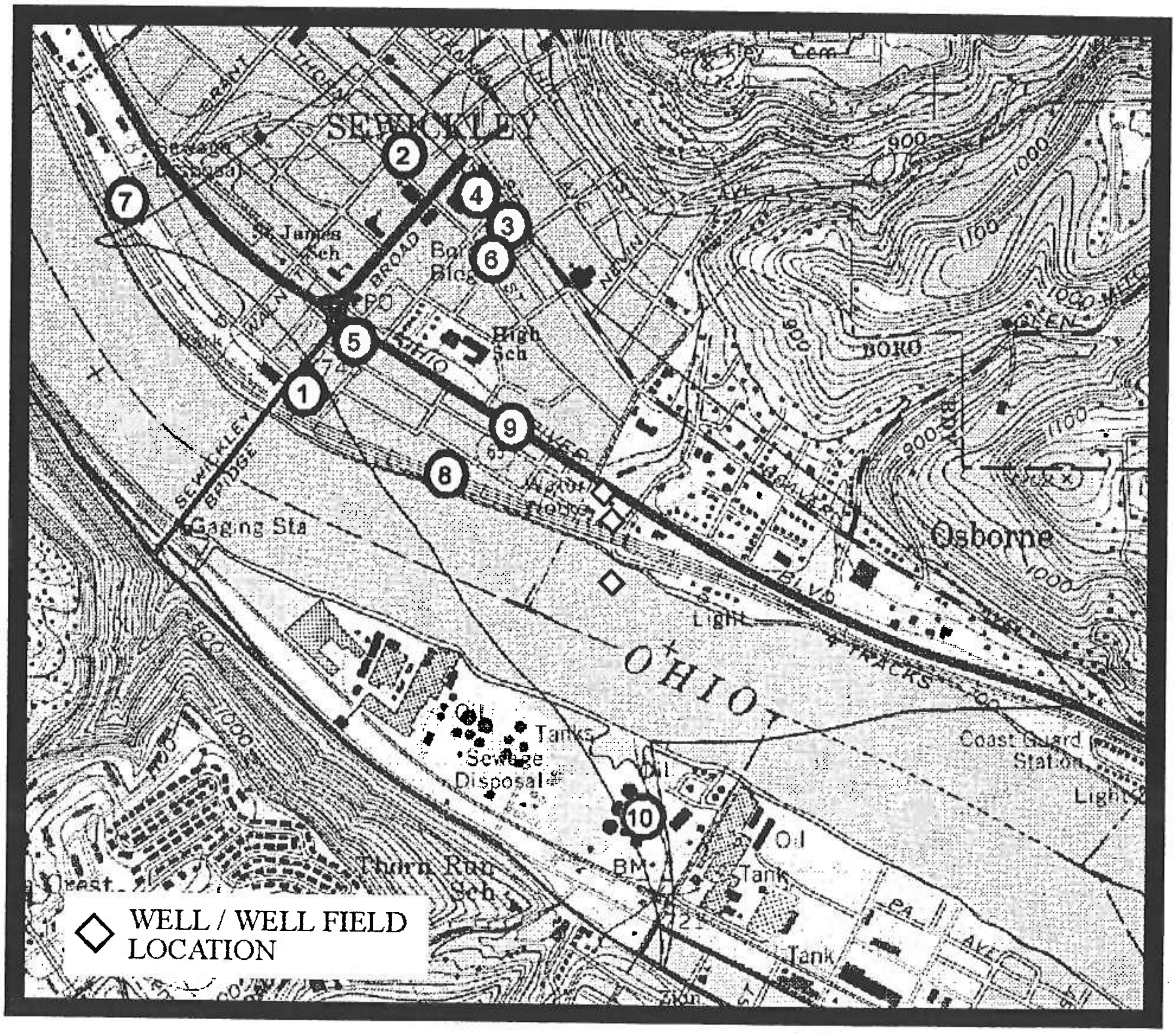
NORTH

SCALE: 1 inch = 1000 feet

Borough of Sewickley
Water Authority

Potential Sources of Contamination

1. Gasoline Service Station
2. Gasoline Service Station
3. Gasoline Service Station
4. Gasoline Service Station
5. Auto Dealership
6. Borough Garage - UST
7. Road Salt Storage
8. Railroad Transportation
9. Highway Transportation
10. Star-Texaco Facility



from Ambridge, PA USGS Quadrangle

SEWICKLEY POTENTIAL CONTAMINANT SOURCE INVENTORY MAP

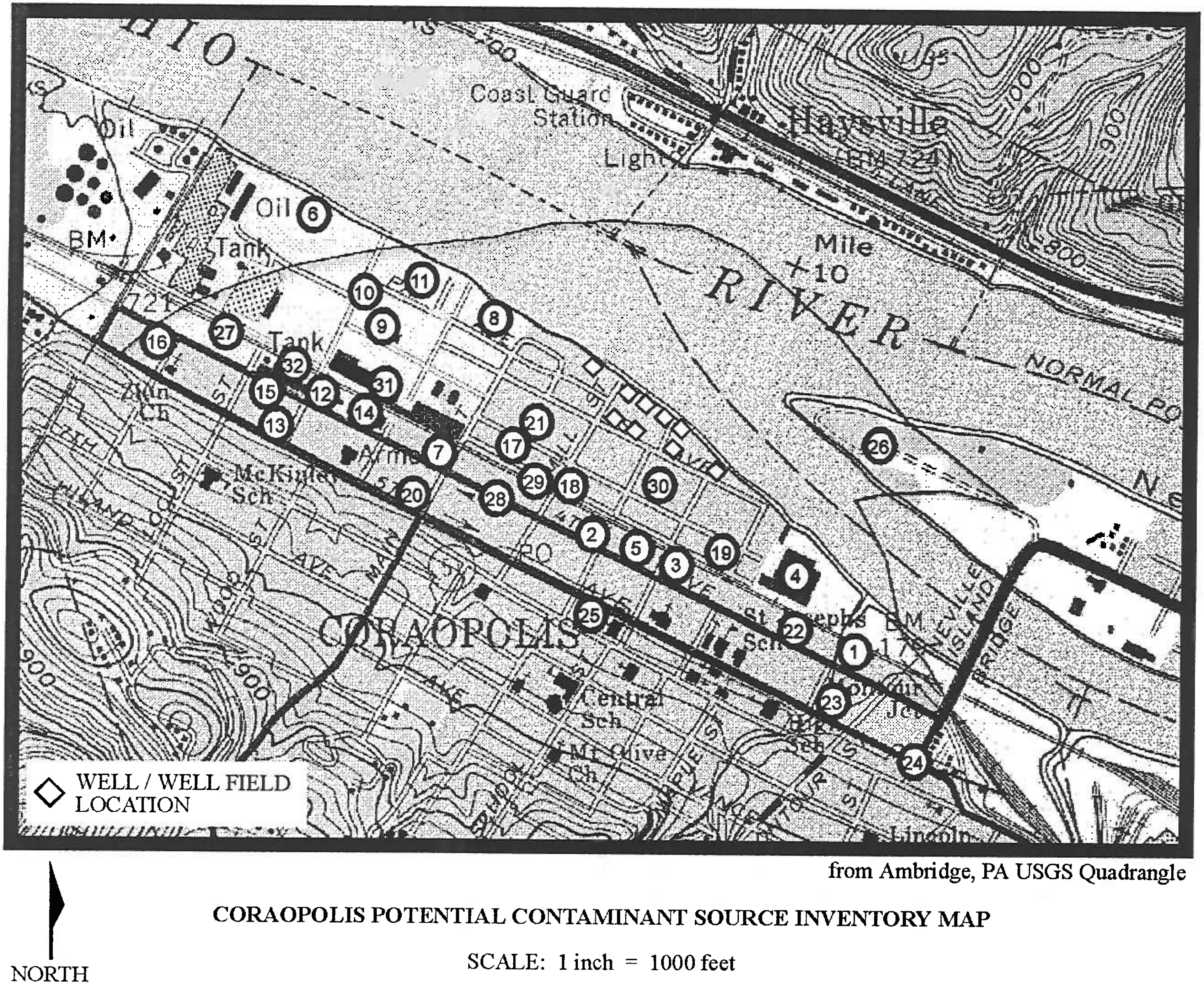
SCALE: 1 inch = 1500 feet

NORTH

Borough of Coraopolis

Potential Sources of Contamination

1. Former Gasoline Service Station
2. Former Gasoline Service Station
3. Bolea Oil - Heating Oil Depot
4. Deur Spring
5. Ace Tire; Service Garage
6. Swartz Bus Garage
7. Former Gasoline Service Station
8. Riverside Cement Plant
9. Shuty Industries
10. Chartiers Paving
11. Standard La Farge
12. B-P Service Station
13. Mobil Service Station
14. AAMCO Transmission Repair
15. Stull Equipment (formerly Standard Steel Spring)
16. Roeffler Co. (formerly Pat Bus Garage)
17. Guardian Industries
18. Energy Components and Toomey Automotive
19. Coraopolis Light Metal and Welding Shop
20. Demasios Auto Repair (former Service Station)
21. Swan Label Company
22. Scrap Yard
23. Van Bales Dry Cleaning
24. Four Service Stations (1 on each corner)
25. Suburban Landscaping
26. Former Neville Chemical Disposal Site
27. Railroad Transportation
28. Highway Transportation
29. Airco High Pressure Line
30. Buckeye Petroleum Products Pipeline
31. Former Homestead Industries' Plant
32. Former American Chemsol Plant



from Ambridge, PA USGS Quadrangle

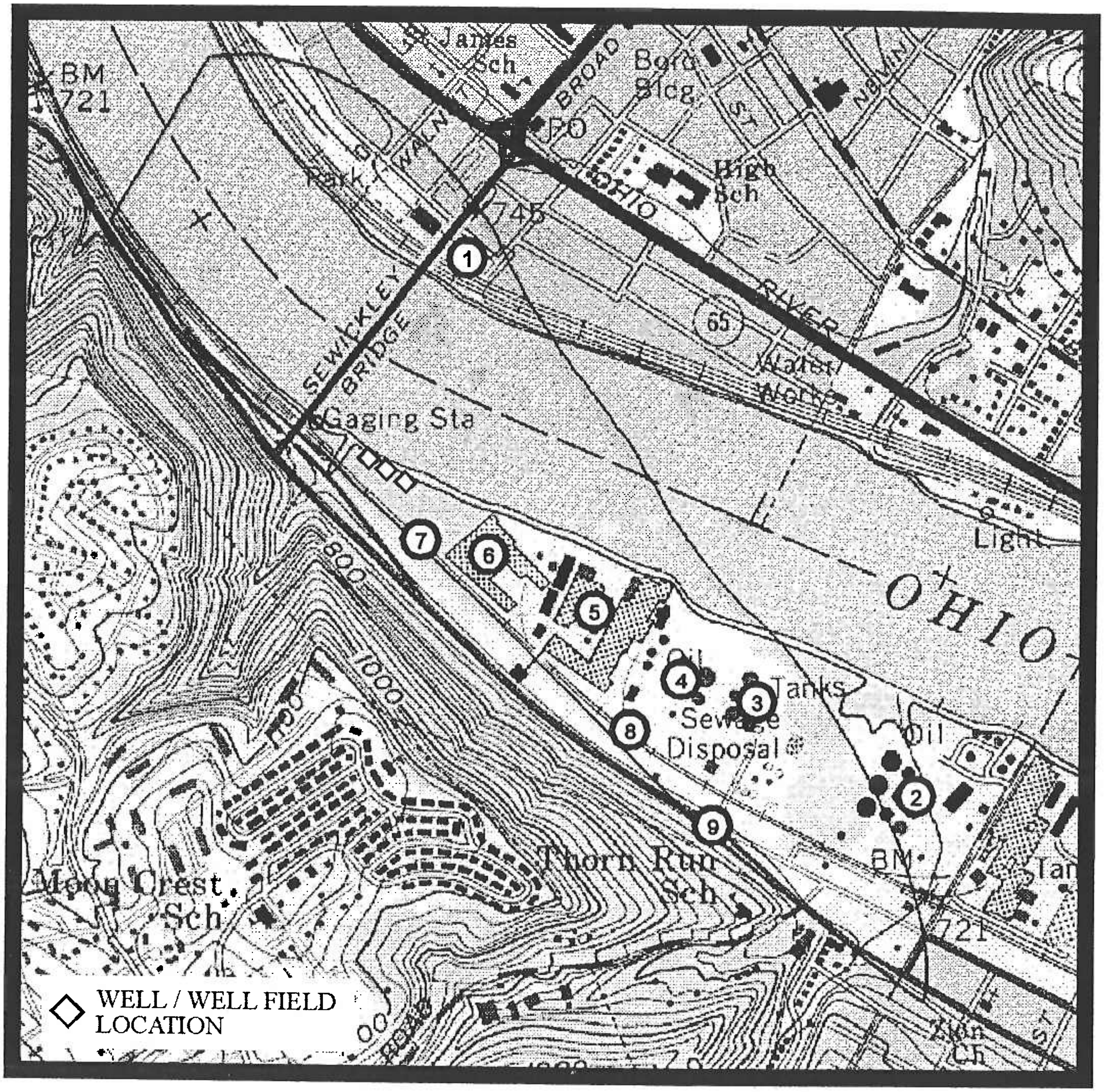
CORAOPOLIS POTENTIAL CONTAMINANT SOURCE INVENTORY MAP

SCALE: 1 inch = 1000 feet

Township of Moon

Potential Sources of Contamination

1. Gasoline Service Station
2. Star-Texaco Facility
3. British Petroleum Facility
4. Buckeye Facility
5. Fab-Tech
6. RB & W
7. Petroleum Pipeline Along Railroad Tracks
8. Railroad Transportation
9. Highway Transportation



from Ambridge, PA USGS Quadrangle

NORTH

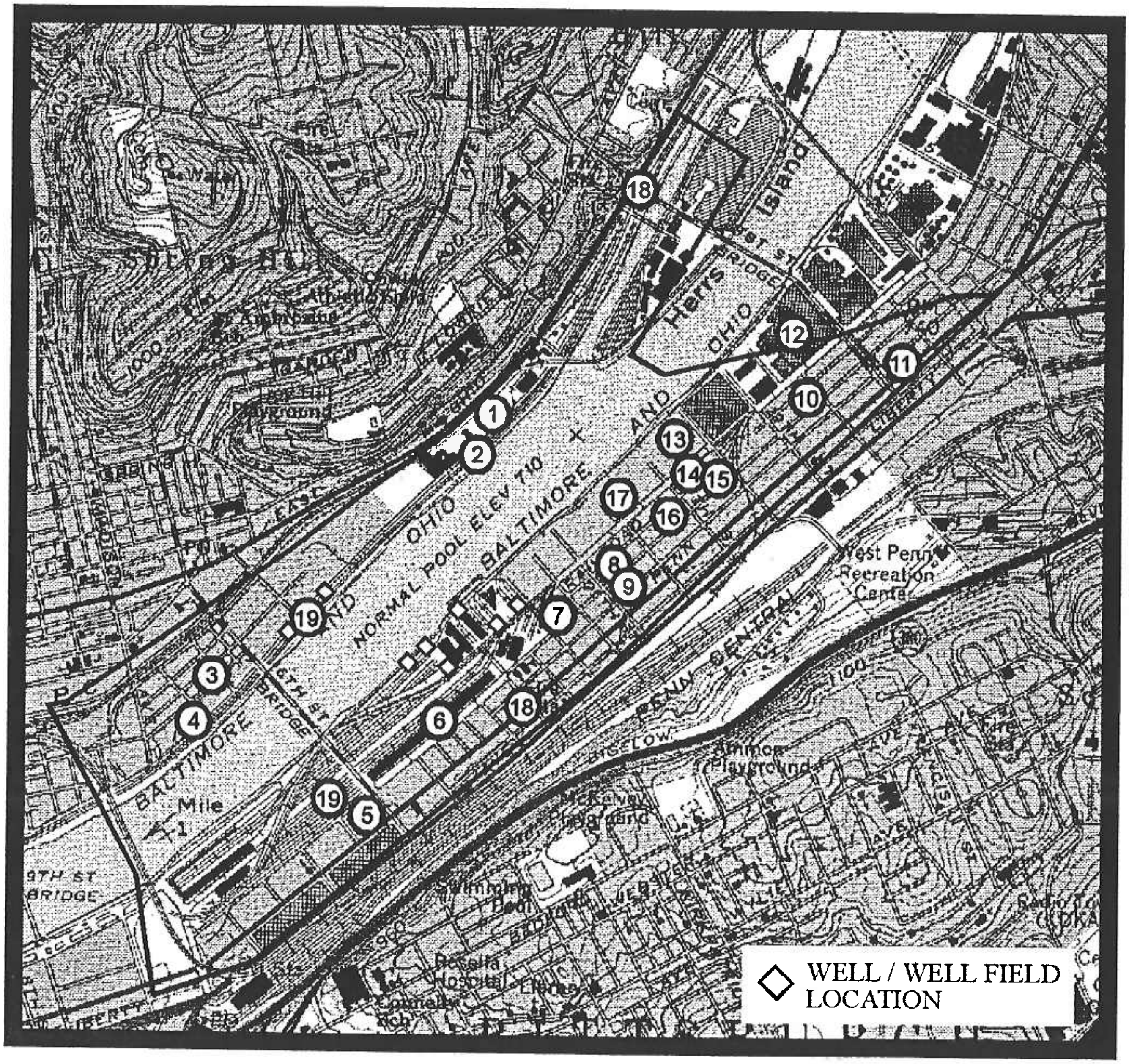
MOON POTENTIAL CONTAMINANT SOURCE INVENTORY MAP

SCALE: 1 inch = 1000 feet

H.J. Heinz Company

Potential Sources of Contamination

1. GSM Engine Warehouse
2. Barge Dock and Repair
3. Auto Body Shop-Vrbanics Car Repair
4. King Trucking
5. Wholey's Fish
6. PA Railroad-Fruit Auction & Sales Bldg.
7. Trane Heating & Air Conditioning
8. Marchase Refrigeration
9. City of Pittsburgh DPW
10. Gateway Paint & Chemical Co. Warehouse
11. H.P. Gazzam Machine Co.
12. Beacon Distribution Services
13. City of Pittsburgh Auto Repair Shop
14. Action Truck Service
15. Duron Paint Warehouse
16. A-1 Truck Service
17. Pitt-Ohio Xpress
18. Highway Transportation
19. Railroad Transportation



from Pittsburgh East, PA USGS Quadrangle

H. J. HEINZ COMPANY POTENITAL CONTAMINANT SOURCE INVENTORY MAP

NORTH

SCALE: 1 inch = 1500 feet

6.0 WELLHEAD PROTECTION MANAGEMENT APPROACHES

6.1 Monitoring Well Installation and Ground Water Monitoring

Ground water monitoring represents one of numerous approaches to wellhead protection management. Installation and sampling of ground water monitoring wells was one of the wellhead protection management approaches adopted for the Allegheny County Wellhead Protection Program.

Ground water monitoring wells were installed and sampled at five water systems included in the study. Existing monitoring/test wells at two additional water systems were also sampled as part of this study.

The monitoring wells were installed in apparent upgradient flow directions from the existing water supply wells and/or within the zone of influence of existing wells. The monitoring wells were also within the wellhead protection areas (WHPA) for the respective water systems. The monitoring wells were located on the same property as the existing water supply wells or on immediately adjacent property.

These monitoring wells were installed and sampled to provide baseline ground water quality data for the respective systems. Future sampling will allow for historical ground water quality trends to be established and to identify the presence of contaminants which could impact the water system supply wells.

The locations of the monitoring wells are shown on maps included as APPENDIX 6-A.

Geological logs and monitoring well construction diagrams are included as APPENDIX 6-B. The results of chemical analyses are included as APPENDIX 6-C.

The monitoring wells were all purged prior to sampling. Standard sampling and preservation protocol was followed. All metal samples were field filtered. The following is a summary of results included in APPENDIX 6-C.

The manganese concentrations exceeded the secondary contaminant level in 6 of the 7 monitoring wells. This confirms that manganese is consistently present in the sand and gravel alluvial deposits in the study area.

Color also exceeded the secondary contaminant level in 5 of the 7 monitoring wells. The presence of elevated color levels results from slightly turbid water due to suspended clay and silt in the monitoring well samples. Elevated iron and manganese concentrations may also contribute to the high color readings.

Each system monitoring well is listed below with those parameters that exceeded a primary or secondary maximum contaminant level.

- ASPINWALL: The iron and manganese concentration exceeded the secondary contaminant level.

- CHESWICK: The color and manganese exceeded the secondary contaminant level.

- CORAOPOLIS: The manganese concentration exceeded the secondary contaminant level.

- EDGEWORTH: The color, dissolved solids, iron and manganese concentrations exceeded the secondary contaminant level.

- HARMAR: Color and manganese concentrations exceeded the secondary contaminant level.

- SEWICKLEY: Cadmium (.0092 mg/l) exceeded the primary contaminant level (.005 mg/l).

- SPRINGDALE: Trichloroethylene (TCE) (.0056 mg/l) slightly exceeded the primary contaminant level (.005 mg/l), color and manganese exceeded the secondary contaminant level.

The results of the monitoring well sampling and analyses provided a baseline for future ground water monitoring and will enable comparisons to be made to identify any significant changes in ground water quality. It is recommended that future sampling be conducted on these monitoring wells at a minimum of annually to continue to establish trends of background quality.

6.2 Wellhead Protection Signs

The installation of wellhead protection signs along key transportation routes throughout the study area was adopted as a wellhead protection management approach for the Allegheny County Wellhead Protection Program.

Due to the urban nature of the study area and the extremely high traffic movement along major transportation routes through the area, the identification of wellhead protection areas was considered to be of key importance in the Allegheny County Wellhead Protection Study.

Several major highways, including Routes 28, 51, and 65, parallel the rivers and these routes pass through portions of capture zones and wellhead protection areas for all of the water systems included in the study.

Wellhead protection signs have been constructed, installed and erected along these major transportation routes. The signs are placed at highly visible locations where the highways pass or enter into wellhead protection areas identified in this study. The locations of sign placement are shown on maps included as APPENDIX 6-D.

The signs have the following information:

WATER SUPPLY AREA
NEXT _______ MILES
SPILL RESPONSE 911

The posting of these signs represents a highly visible and what is believed to be a very effective management approach to ground water protection in Allegheny County.

6.3 Development of Model Ordinances and Inspection Programs

The Allegheny County Planning Department and the Allegheny County Health Department will continue development and implementation of wellhead protection management approaches. These management approaches include the following:

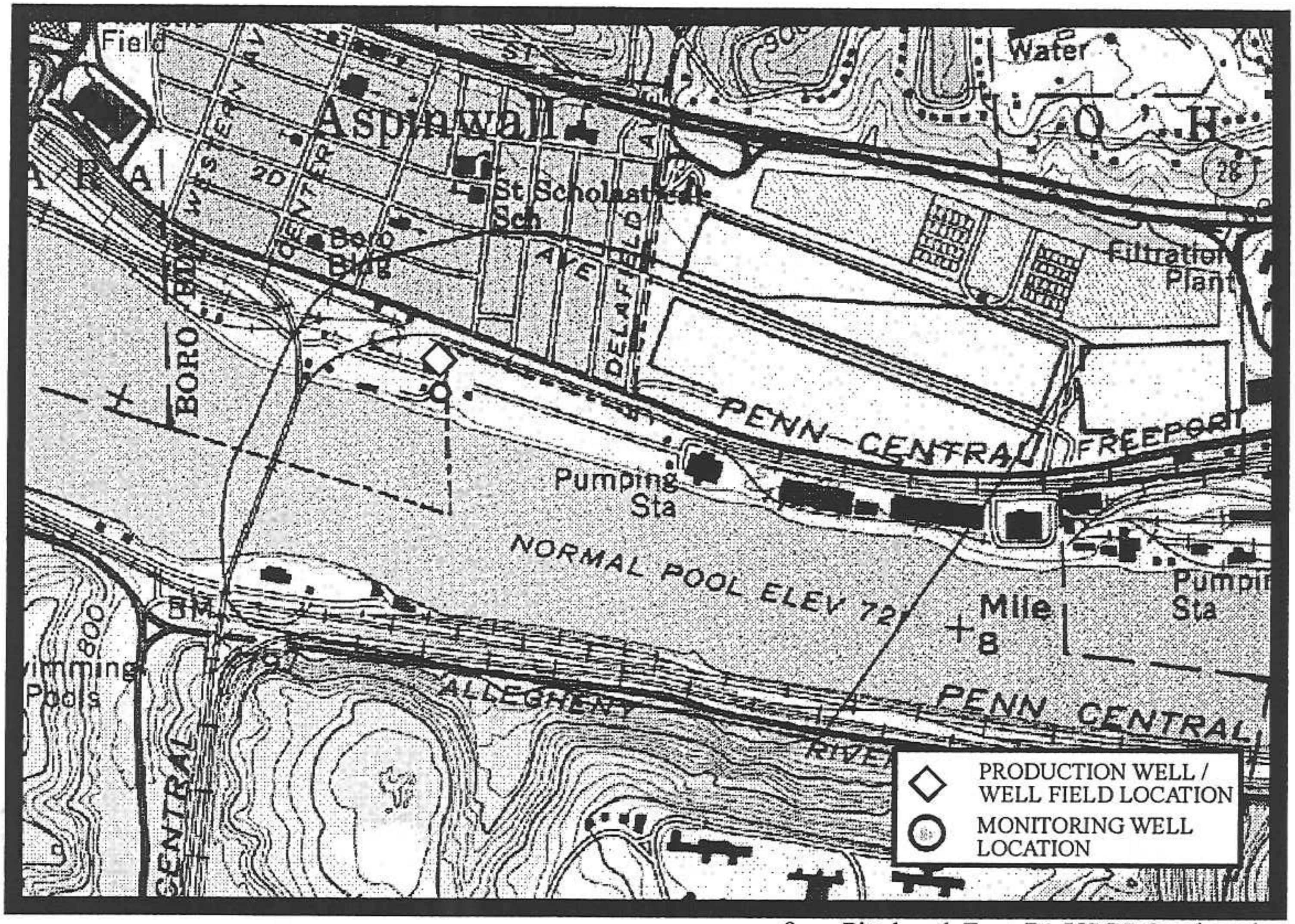
- Modification of the Allegheny County model municipal ordinances as necessary to provide for consideration of Wellhead Protection Areas (Capture Zones) in zoning and land use decisions.
- Development of a model inspection ordinance to authorize municipalities and/or authorities to inspect facilities to identify and monitor the handling, storage and disposal of compounds which pose a contamination risk.
- Preparation of a guidance document for implementing inspection program.
- Initiation of first inspections at targeted priority sites.
- Completion of one round of inspections for each water supply.

The proposed workplan for these activities targets completion of the model ordinances and guidance document within twelve months. Inspection programs will require that municipalities first pass an inspection ordinance. After passage, ACHD will assist the municipalities in completing an initial round of inspections. With the cooperation and participation of the municipalities, water suppliers and ACHD, initial inspections in each municipality will be completed within 36 months.

The wellhead protection management approaches already completed in this study, and those listed above that are on-going, represent an effective and comprehensive approach to wellhead protection in Allegheny County.

APPENDIX 6-A

Allegheny County Wellhead Protection Study
Monitoring Well Locations

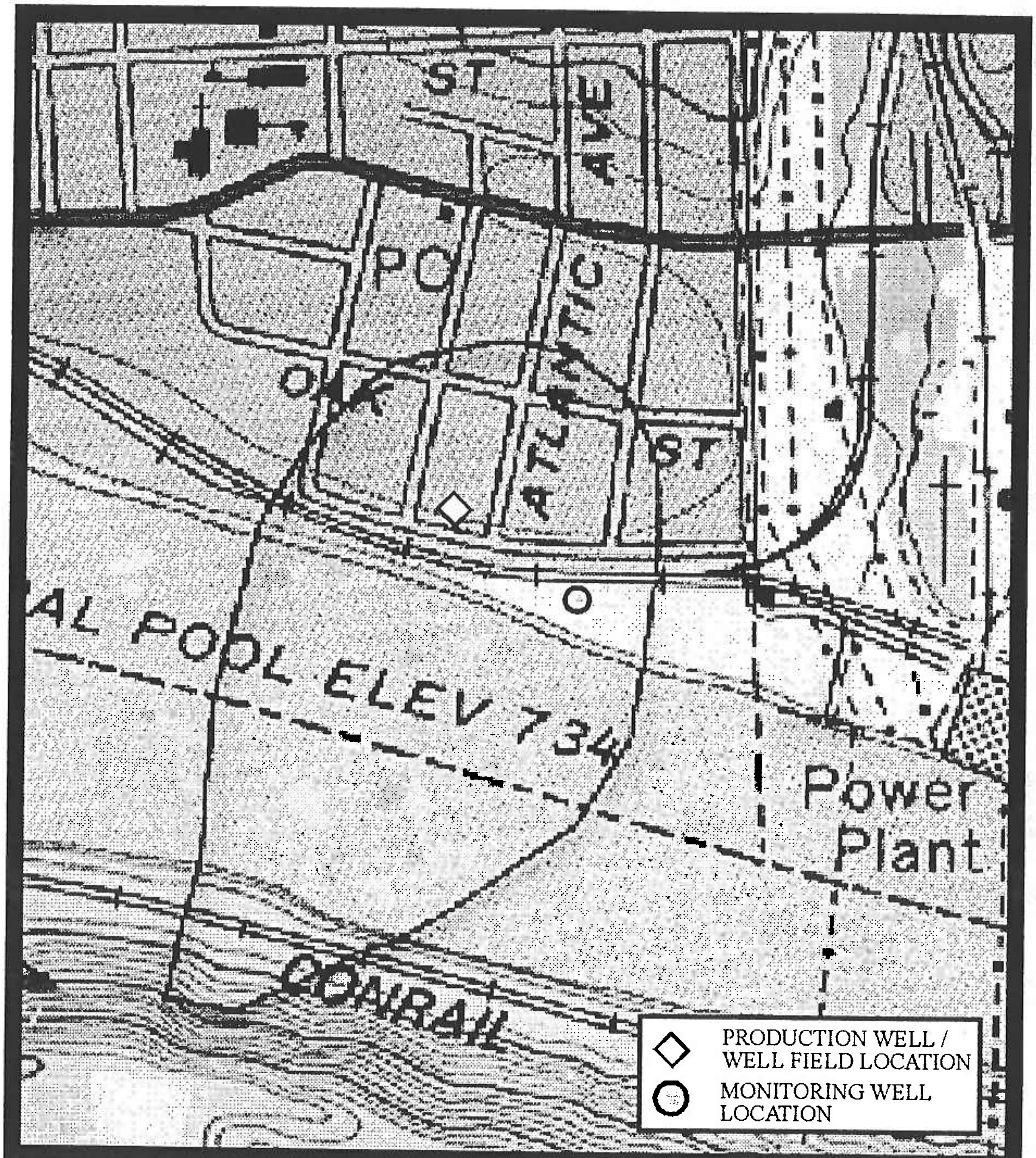


from Pittsburgh East, PA USGS Quadrangle

ASPINWALL MONITORING WELL LOCATION MAP

NORTH

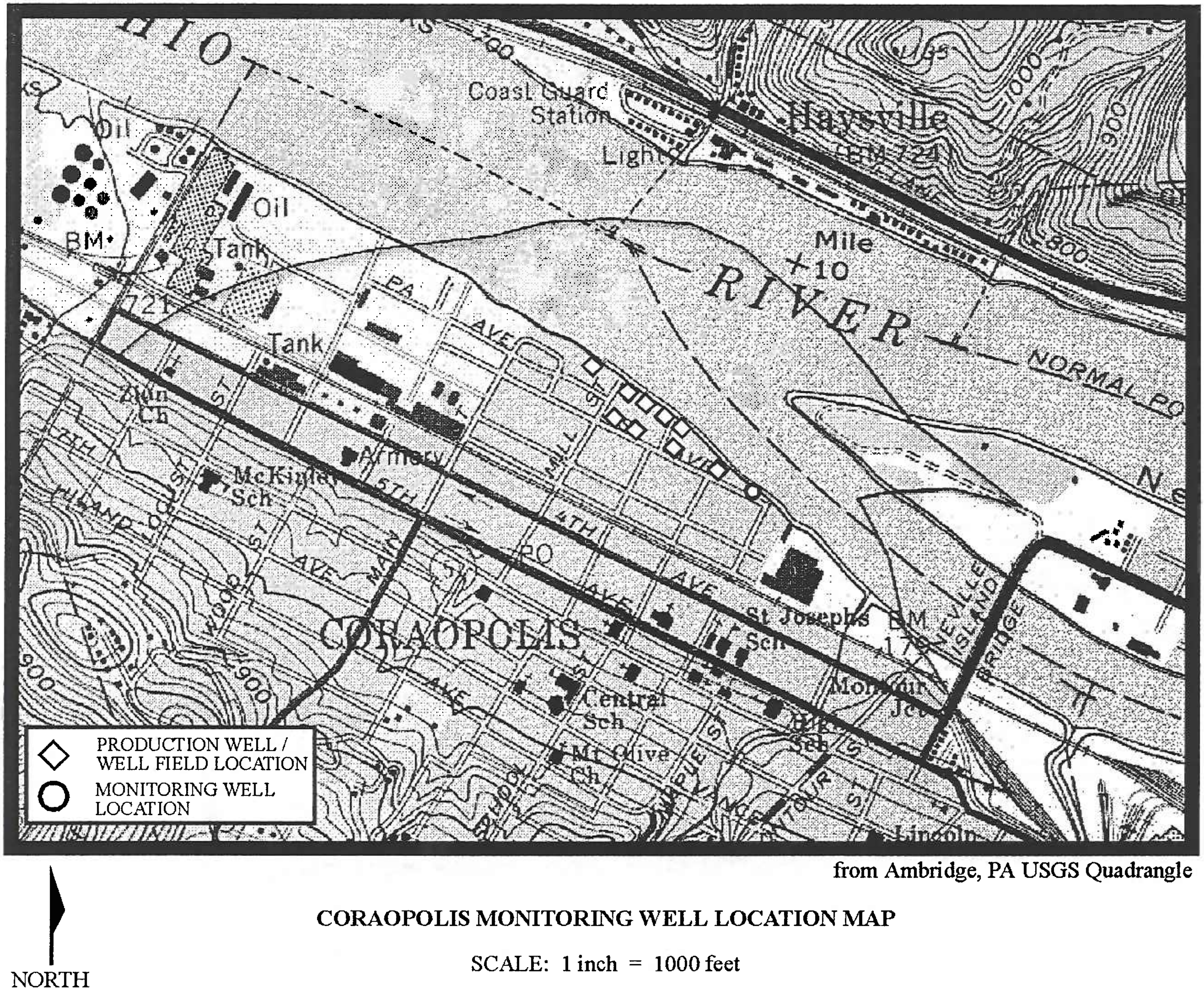
SCALE: 1 inch = 1000 feet



from New Kensington West, PA USGS Quadrangle

CHESWICK MONITORING WELL LOCATION MAP

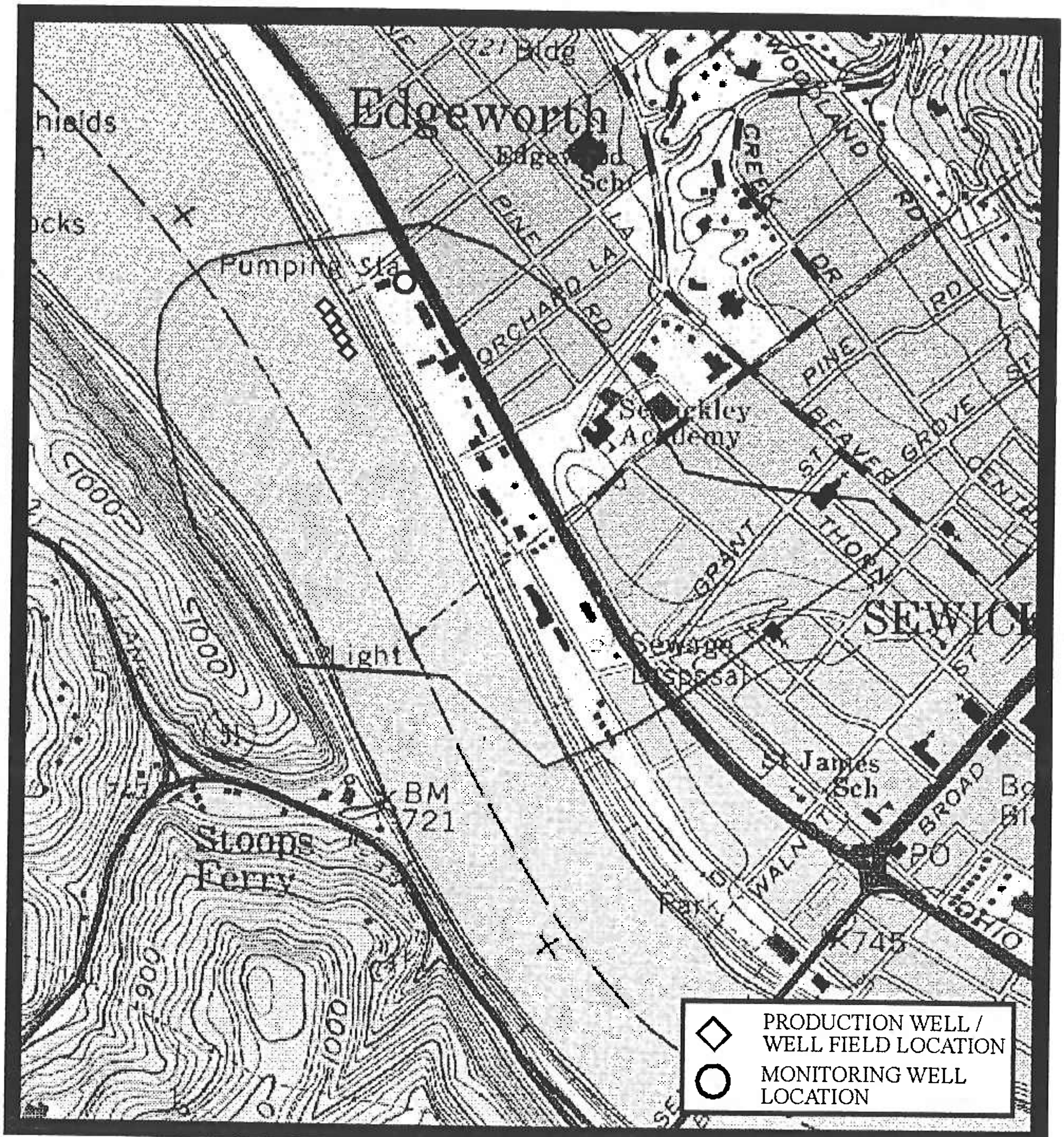
SCALE: 1 inch = 500 feet



from Ambridge, PA USGS Quadrangle

CORAOPOLIS MONITORING WELL LOCATION MAP

SCALE: 1 inch = 1000 feet

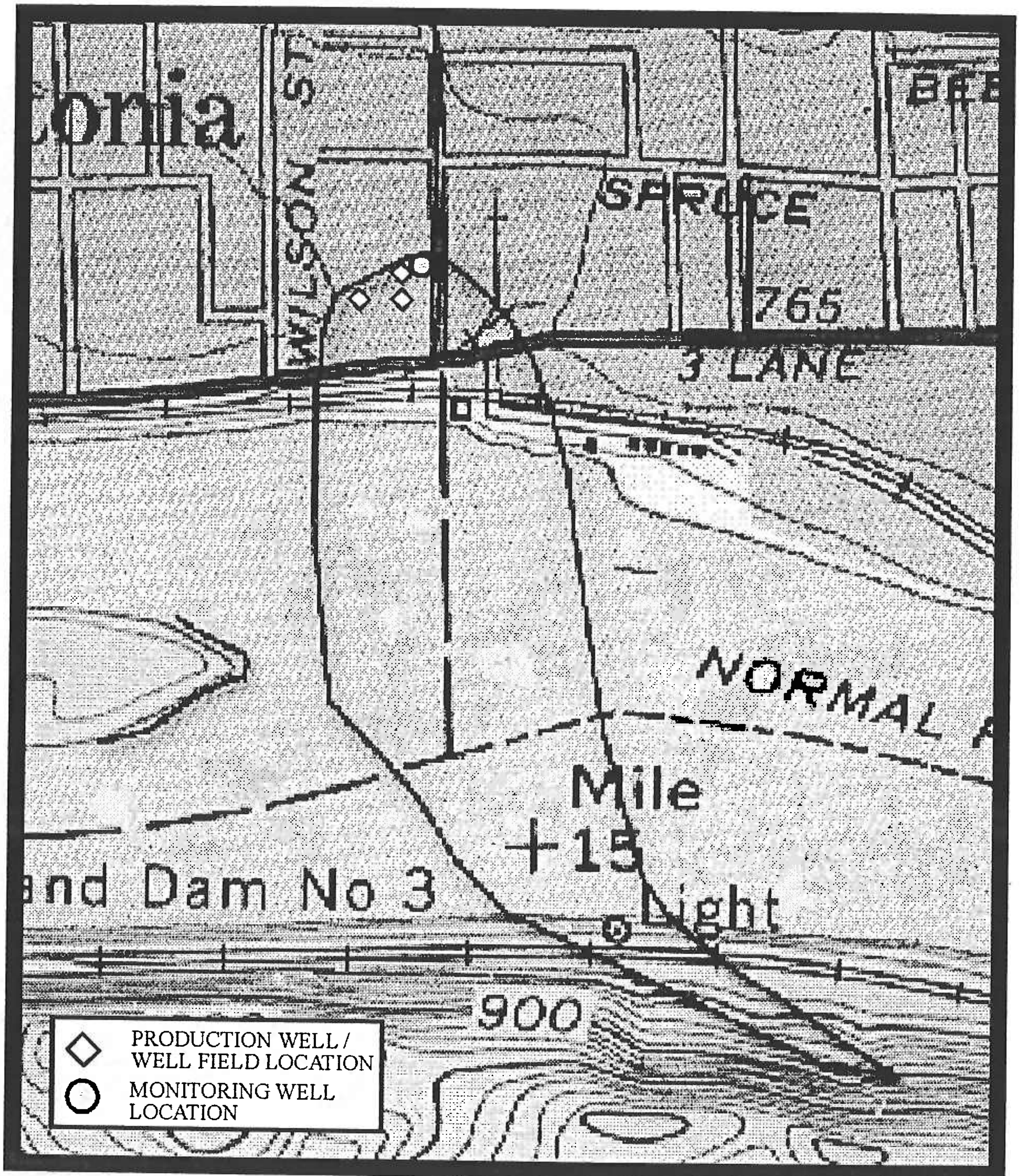


from Ambridge, PA USGS Quadrangle

EDGEWORTH MONITORING WELL LOCATION MAP

NORTH

SCALE: 1 inch = 1000 feet

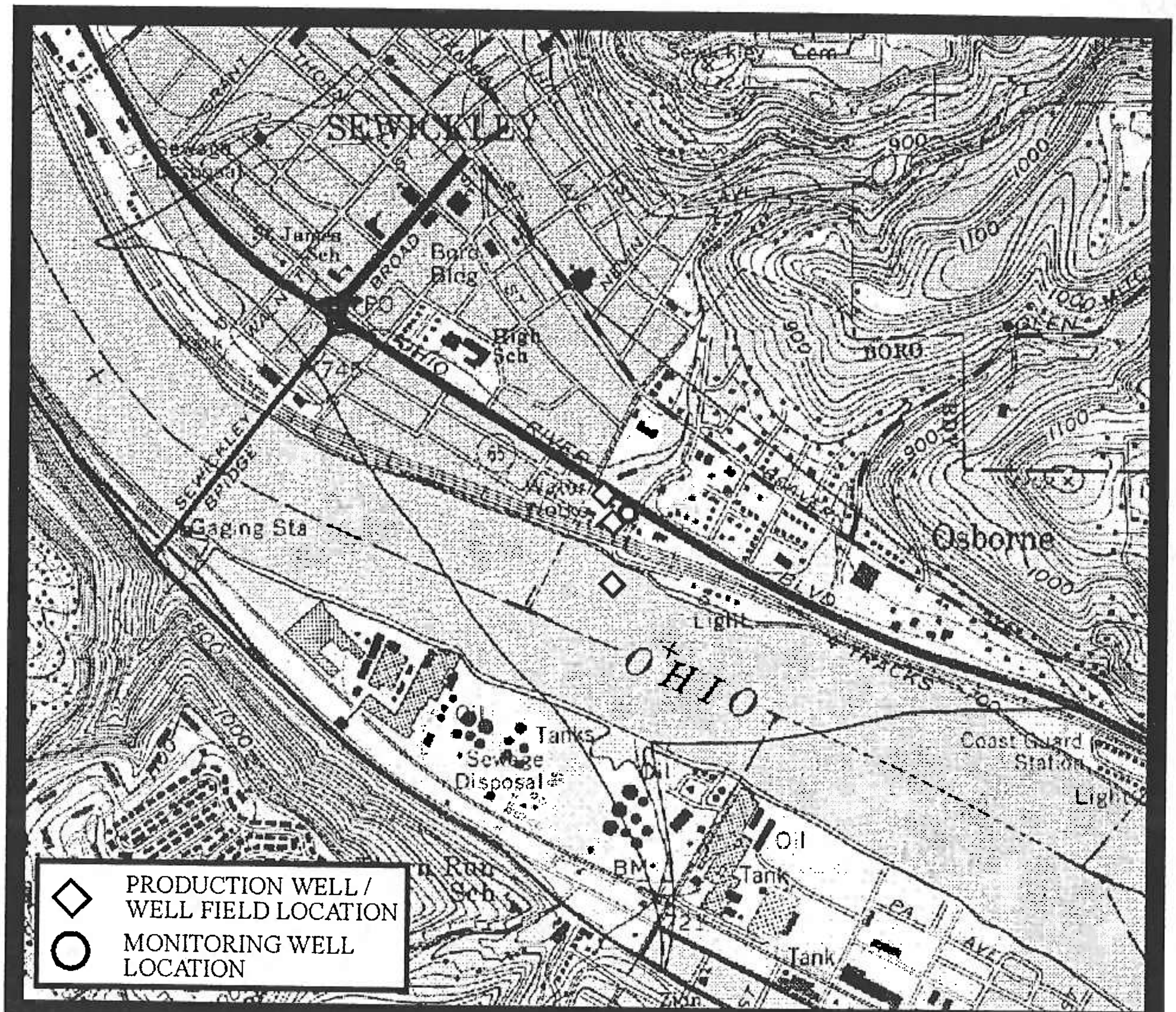


from New Kensington West, PA USGS Quadrangle

HARMAR MONITORING WELL LOCATION MAP

NORTH

SCALE: 1 inch = 500 feet

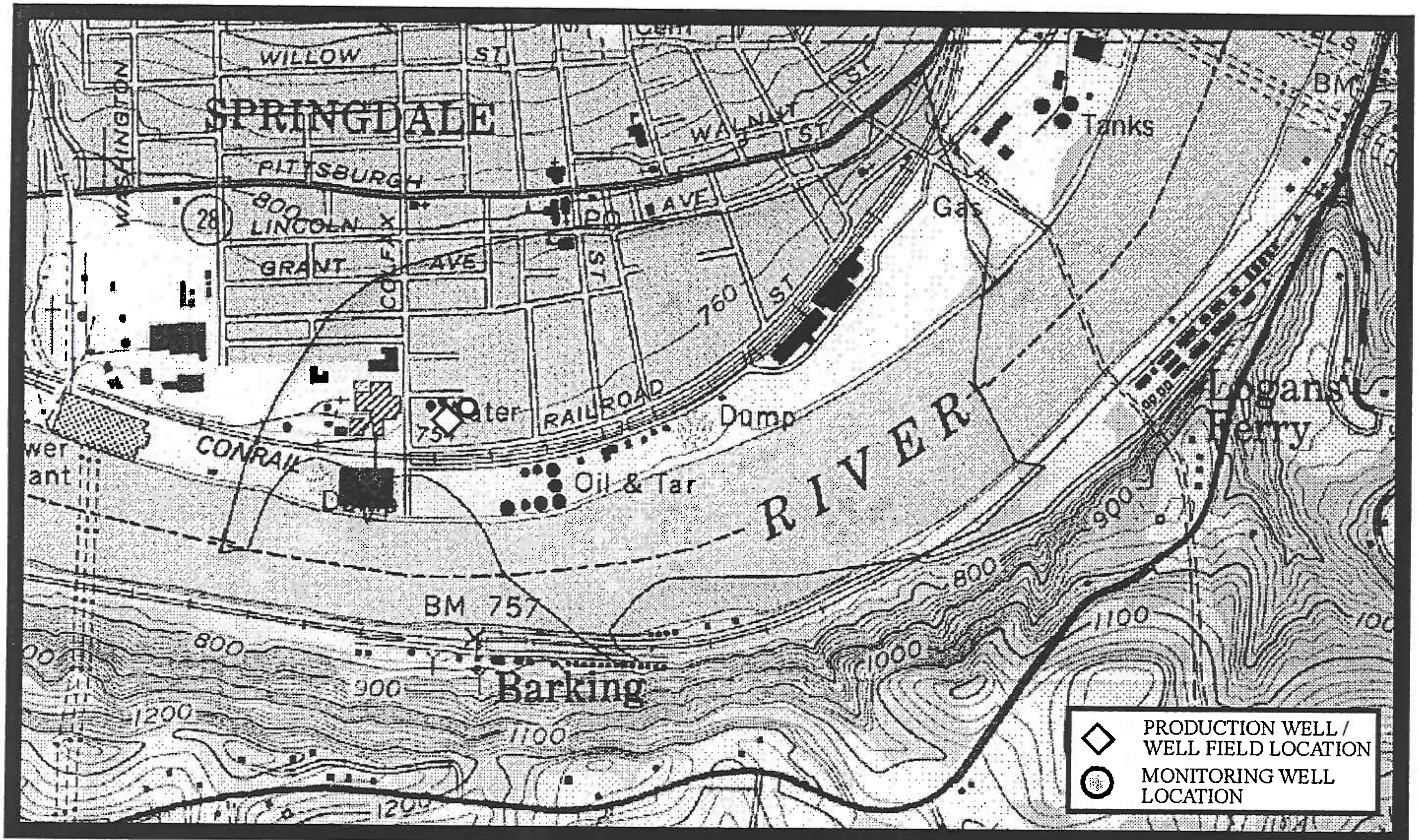


from Ambridge, PA USGS Quadrangle

SEWICKLEY MONITORING WELL LOCATION MAP

SCALE: 1 inch = 1500 feet

NORTH



from New Kensington West, PA USGS Quadrangle

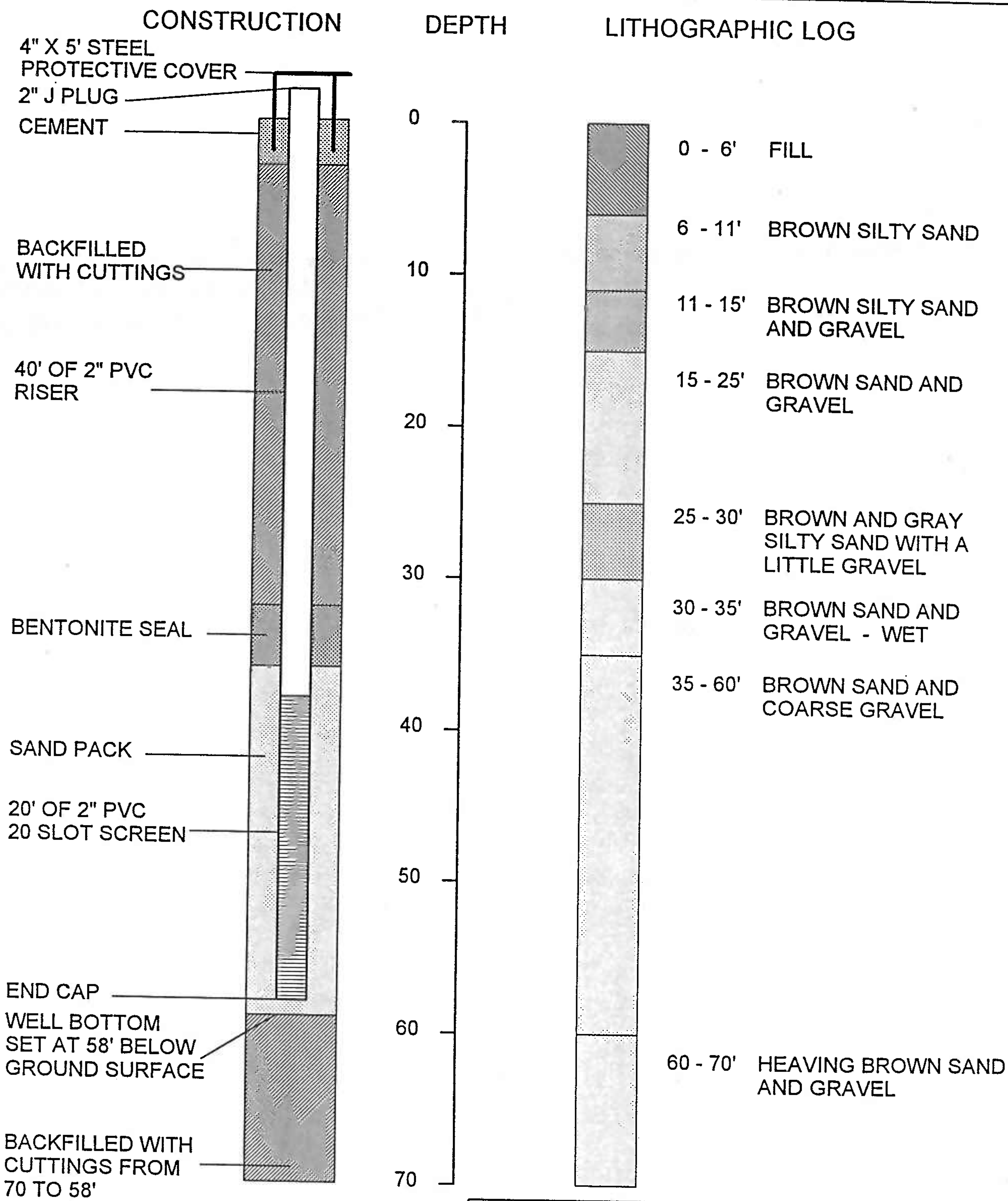
NORTH

SPRINGDALE MONITORING WELL LOCATION MAP

SCALE: 1 inch = 1000 feet

APPENDIX 6-B

Allegheny County Wellhead Protection Study
Geological and Monitoring Well Construction Logs



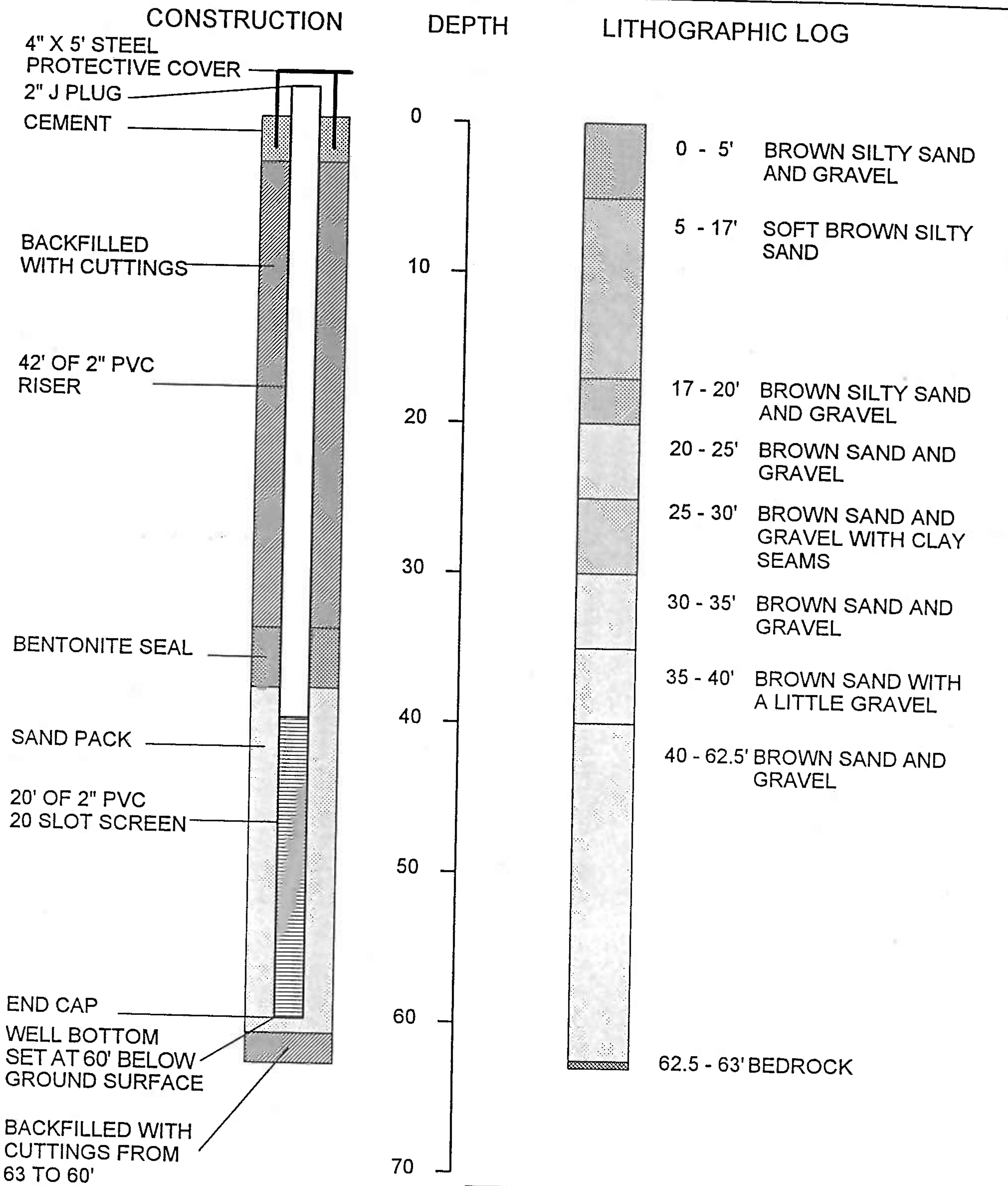
MONITORING WELL CONSTRUCTION DETAILS AND LITHOGRAPHIC LOG

BOROUGH OF CHESWICK, PENNSYLVANIA

VERTICAL SCALE

1" = 10'

Moody and Associates, Inc.



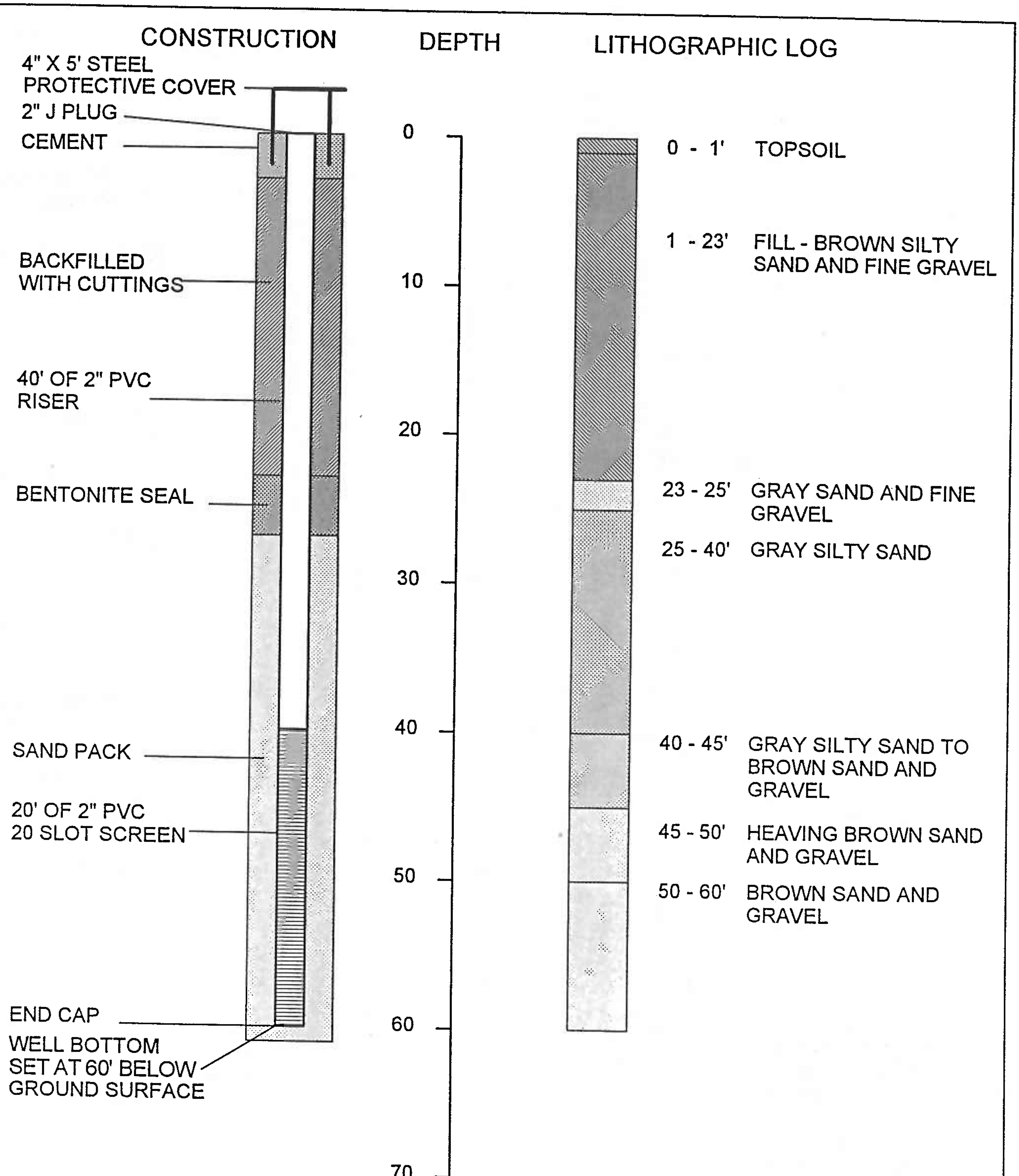
MONITORING WELL CONSTRUCTION DETAILS AND LITHOGRAPHIC LOG

BOROUGH OF CORAOPOLIS, PENNSYLVANIA

VERTICAL SCALE

1" = 10'

Moody and Associates, Inc.



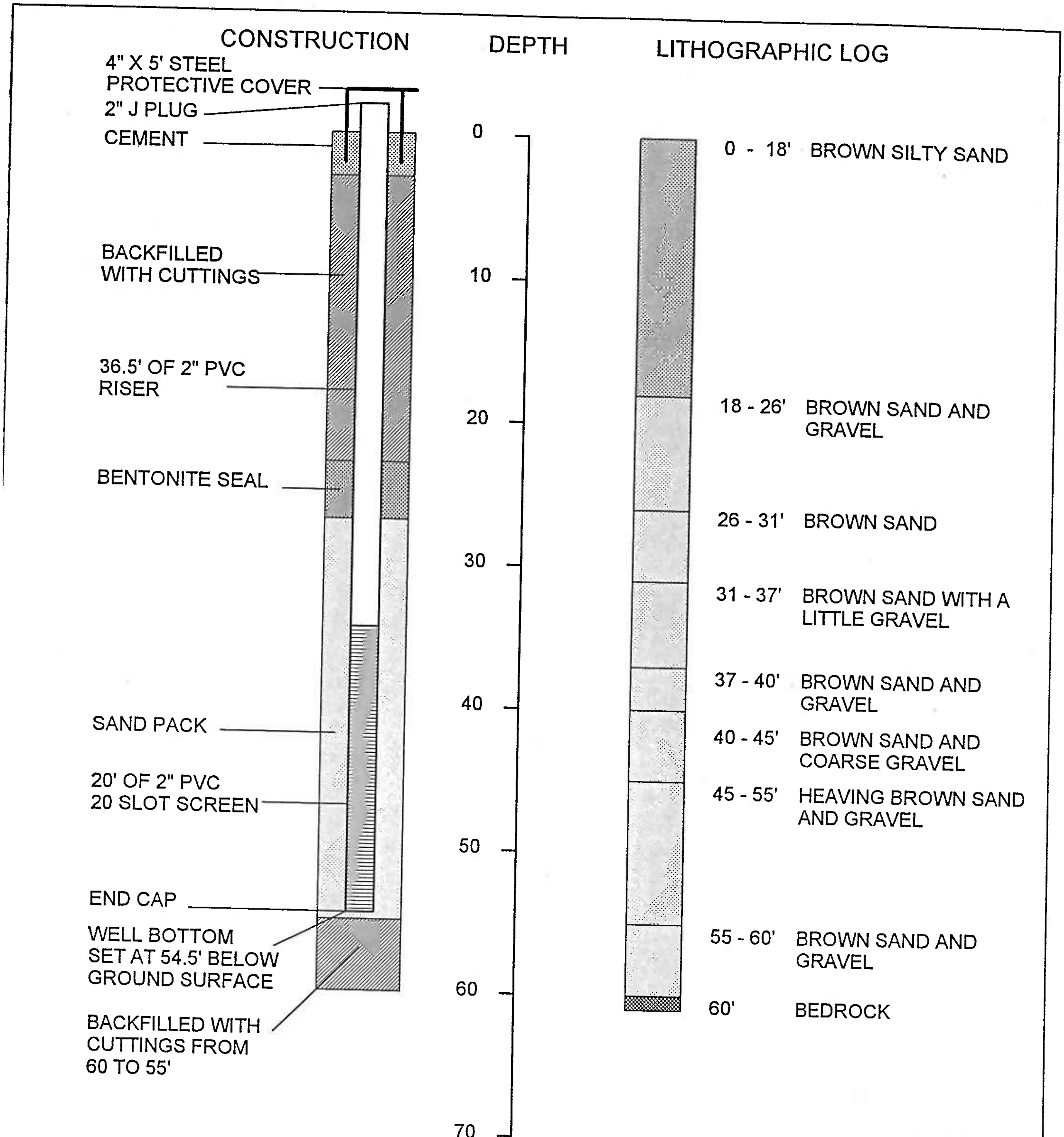
MONITORING WELL CONSTRUCTION DETAILS AND LITHOGRAPHIC LOG

BOROUGH OF EDGEWORTH, PENNSYLVANIA

VERTICAL SCALE

1" = 10'

Moody and Associates, Inc.



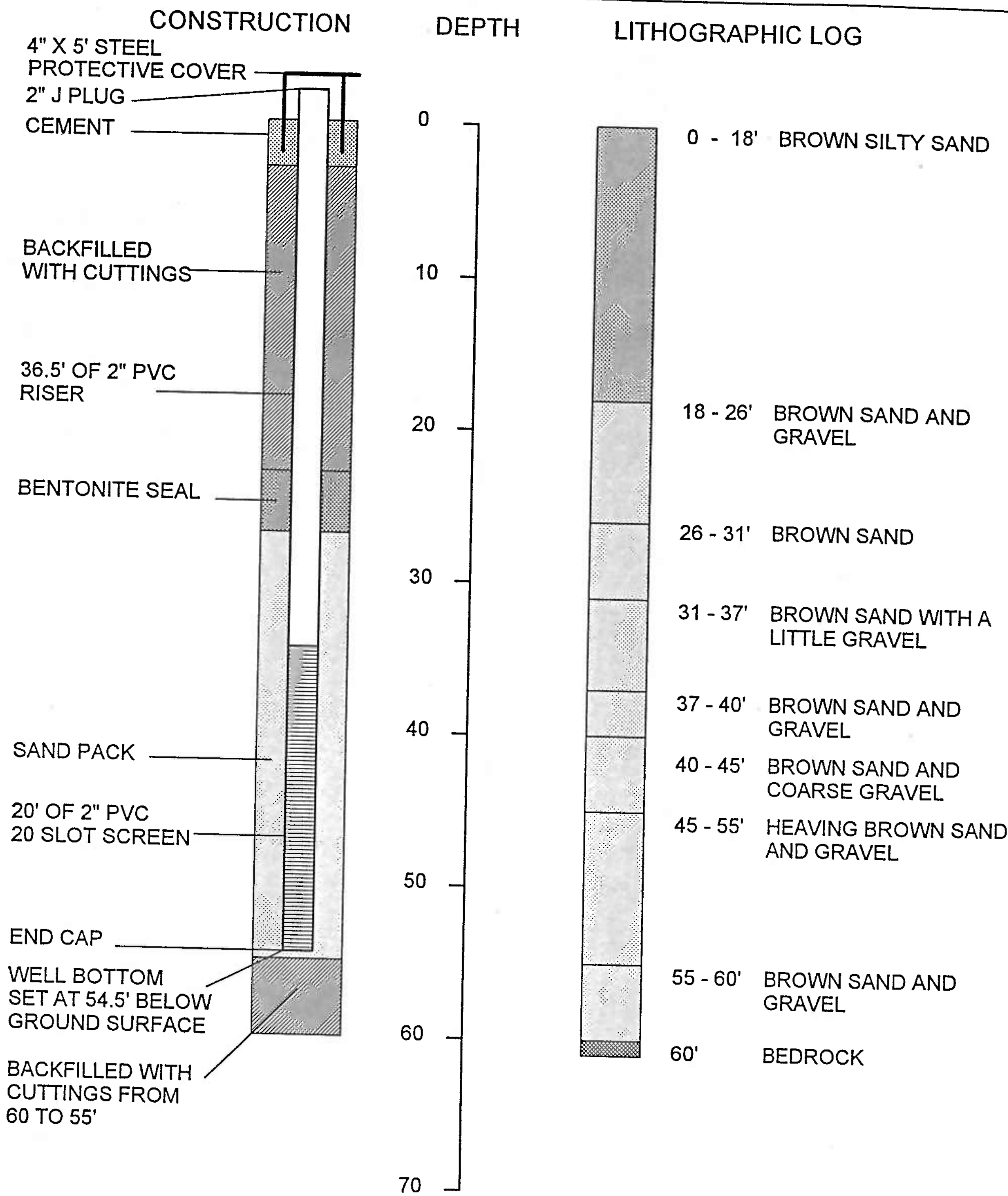
MONITORING WELL CONSTRUCTION DETAILS AND LITHOGRAPHIC LOG

MUNICIPAL AUTHORITY OF HARMAR TOWNSHIP, PENNSYLVANIA

VERTICAL SCALE

1" = 10'

Moody and Associates, Inc.



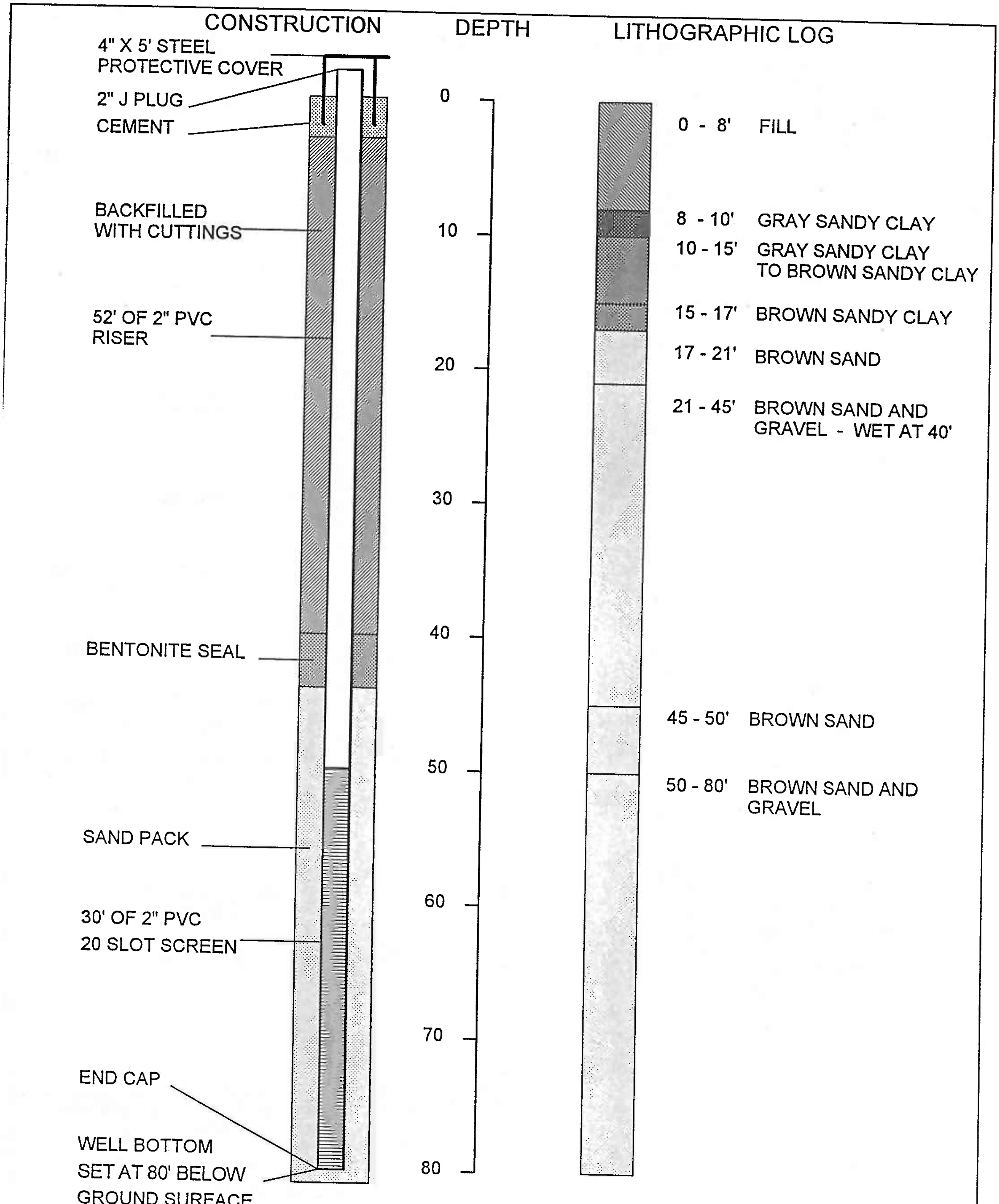
MONITORING WELL CONSTRUCTION DETAILS AND LITHOGRAPHIC LOG

MUNICIPAL AUTHORITY OF HARMAR TOWNSHIP, PENNSYLVANIA

VERTICAL SCALE

1" = 10'

Moody and Associates, Inc.



MONITORING WELL CONSTRUCTION DETAILS AND LITHOGRAPHIC LOG	VERTICAL SCALE 1" = 10'	Moody and Associates, Inc.
BOROUGH OF SEWICKLEY, PENNSYLVANIA		

APPENDIX 6-C

Allegheny County Wellhead Protection Study
Chemical Analyses from Monitoring Wells

FREE-COL LABORATORIES, INC.

P.O. BOX 557,COTTON ROAD
MEADVILLE, PENNSYLVANIA 16335
PHONE: (814) 724-6242
FAX: (814) 333-1466

5815 AIRPORT ROAD
ROANOKE, VIRGINIA 24012
PHONE: (703) 265-2544
FAX: (703) 362-1663

07/07/95

TO:

MOODY & ASSOCIATES

R.D. #4, COTTON RD.
MEADVILLE PA 16335

P.O. #

RE: ALLEGHENY CO. WHP

ACCOUNT NO. 00222

ANALYTICAL REPORT FORM

PARAMETER	SAMPLE ID :	CORAOPOLIS BAILED 06/21/95	EDGEWORTH BAILED 06/21/95	SEWICKLEY BAILED 06/21/95
	LAB ID	50621133	50621134	50621135
	DATE RECEIVED:	06/21/95	06/21/95	06/21/95
ARSENIC HYD. (DISS.) MG/L		<0.0005	0.0138	<0.0005
FLUORIDE (DIST) MG/L		0.5	0.8	0.3
MERCURY (DISS.) MG/L		<0.0001	<0.0001	<0.0001
NO3-N MG/L		0.95	0.36	2.72
NO2-N MG/L		<0.05	0.61	<0.005
SELENIUM DISS. MG/L		<0.0005	<0.0005	<0.0005
ALKALINITY MG/L		129	183	134
CHLORIDE MG/L		2.5	110	96.3
COLOR CU		10	500	15
HARDNESS MG/L		252	252	244
SULFATE MG/L		101	105	112
SOLIDS,DISS. MG/L		322	576	480
BARIUM ICP (DISS.) MG/L		0.07	0.09	0.05

Please reference the following page(s) for date and analyst.

M .DVILLE DIVISION
A.I.H.A. Accreditation No. 98
U.S. Public Health Services Approved Facility
PA D.E.R. Laboratory I.D. No. 20-073
P Dept. of Agriculture Approved Dairy Laboratory
N Dept. of Health Laboratory I.D. No. 10552
NY Dept. of Env. Conservation [illegible]

ND Dept. of Health Cert. No. R-083
MD Dept. of Health Cert. No. 130
VA Dept. of Health Laboratory I.D. No. 00145
WV Dept. of Health Certification No. 9907C
NC Dept. of Natural Resources Cert. No. 236
MI Dept. of Public Health Approved Facility

ROANOKE DIVISION
VA Dept. of Health Laboratory I.D. No. 00143

FREE-COL LABORATORIES, INC.
P.O. BOX 557,COTTON ROAD
MEADVILLE, PENNSYLVANIA 16335
PHONE: (814) 724-6242
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5815 AIRPORT ROAD
ROANOKE, VIRGINIA 24012
PHONE: (703) 265-2544
FAX: (703) 362-1663

07/07/95

TO:
MOODY & ASSOCIATES
R.D. #4, COTTON RD.
MEADVILLE PA 16335

P.O. #
RE: ALLEGHENY CO. WHP
ACCOUNT NO. 00222

ANALYTICAL REPORT FORM

PARAMETER	SAMPLE ID / LAB ID / DATE RECEIVED:	CORAOPOLIS BAILED 06/21/95	EDGEWORTH BAILED 06/21/95	SEWICKLEY BAILED 06/21/95
	LAB ID	50621133	50621134	50621135
	DATE RECEIVED:	06/21/95	06/21/95	06/21/95
CADMIUM G.F. (DISS.) MG/L		0.0030	0.0037	0.0092
CHROMIUM G.F.(DISS.) MG/L		<0.001	0.001	<0.001
COPPER DISS. MG/L		<0.02	<0.02	<0.02
LEAD G.F. (DISS.) MG/L		0.002	0.002	0.001
NICKEL DISS. MG/L		<0.04	<0.04	<0.04
IRON ICP (DISS.) MG/L		0.06	15.2	0.08
MANGANESE (DISS.) MG/L		0.12	3.53	0.05

Please reference the following page(s) for date and analyst.

FREE-COL LABORATORIES, INC.
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MEADVILLE, PENNSYLVANIA 16335
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5815 AIRPORT ROAD
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07/07/95

TO:
MOODY & ASSOCIATES

R.D. #4, COTTON RD.
MEADVILLE PA 16335

P.O. #

RE: ALLEGHENY CO. WHP
ACCOUNT NO. 00222

ANALYTICAL REPORT FORM

PARAMETER	SAMPLE ID : LAB ID DATE RECEIVED:	ASPINWALL BAILED 06/21/95 50621136 06/21/95	HARMAR BAILED 06/21/95 50621137 06/21/95	CHESWICK BAILED 06/21/95 50621138 06/21/95
ARSENIC HYD. (DISS.) MG/L		<0.0005	<0.0005	0.0005
FLUORIDE (DIST) MG/L		0.3	1.0	0.2
MERCURY (DISS.) MG/L		<0.0001	<0.0001	<0.0001
NO3-N MG/L		0.26	0.39	0.42
NO2-N MG/L		<0.05	<0.05	<0.05
SELENIUM DISS. MG/L		<0.0005	<0.0005	<0.0005
ALKALINITY MG/L		112	100	259
CHLORIDE MG/L		34.9	15.7	27.9
COLOR CU		30	60	25
HARDNESS MG/L		166	122	224
SULFATE MG/L		50	44	105
SOLIDS,DISS. MG/L		312	246	422
BARIUM ICP (DISS.) MG/L		0.07	0.03	0.09

Please reference the following page(s) for date and analyst.

FREE-COL LABORATORIES, INC.
P.O. BOX 557,COTTON ROAD
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MEADVILLE PA 16335

P.O. #

RE: ALLEGHENY CO. WHP

ACCOUNT NO. 00222

ANALYTICAL REPORT FORM

PARAMETER				
	SAMPLE ID :	ASPINWALL BAILED 06/21/95	HARMAR BAILED 06/21/95	CHESWICK BAILED 06/21/95
	LAB ID	50621136	50621137	50621138
	DATE RECEIVED:	06/21/95	06/21/95	06/21/95
CADMIUM G.F. (DISS.) MG/L		0.0004	0.0003	0.0017
CHROMIUM G.F.(DISS.) MG/L		<0.001	<0.001	<0.001
COPPER DISS. MG/L		<0.02	<0.02	<0.02
LEAD G.F. (DISS.) MG/L		0.001	0.001	0.001
NICKEL DISS. MG/L		<0.04	<0.04	<0.04
IRON ICP (DISS.) MG/L		1.47	0.03	0.07
MANGANESE (DISS.) MG/L		1.18	1.88	1.20

Please reference the following page(s) for date and analyst.

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5815 AIRPORT ROAD
ROANOKE, VIRGINIA 24012
PHONE: (703) 265-2544
FAX: (703) 362-1663

07/07/95

TO:
MOODY & ASSOCIATES
R.D. #4, COTTON RD.
MEADVILLE PA 16335

P.O. #
RE: ALLEGHENY CO. WHP
ACCOUNT NO. 00222

ANALYTICAL REPORT FORM

SAMPLE ID : SPRINGDALE
BAILED
06/21/95
LAB ID 50621139
DATE RECEIVED: 06/21/95

PARAMETER	RESULTS	UNITS	DATE AND	ANALYST
Arsenic Hydride (diss.)	<0.0005	MG/L	06/30/95	KOZAKOVSKY
Fluoride (distilled)	0.3	MG/L	07/05/95	PHELAN
Mercury (diss.)	<0.0001	MG/L	06/26/95	KOZAKOVSKY
Nitrogen, Nitrate	1.45	MG/L	06/28/95	PEARSON
Nitrogen, Nitrite	<0.05	MG/L	06/21/95	PEARSON
Selenium Hydride (dissolved)	<0.0005	MG/L	06/30/95	KOZAKOVSKY
Alkalinity	228	MG/L	06/22/95	PHELAN
Chloride	35.5	MG/L	06/23/95	PEARSON
Color	25	CU	06/21/95	MOOK/ PEARSON
Hardness	278	MG/L	06/22/95	NORDSTROM/ MOOK
Sulfate	126	MG/L	06/27/95	PHELAN

FREE-COL LABORATORIES, INC.

P.O. BOX 557,COTTON ROAD
MEADVILLE, PENNSYLVANIA 16335
PHONE: (814) 724-6242
FAX: (814) 333-1466

5815 AIRPORT ROAD
ROANOKE, VIRGINIA 24012
PHONE: (703) 265-2544
FAX: (703) 362-1663

07/07/95

TO:

MOODY & ASSOCIATES

R.D. #4, COTTON RD.
MEADVILLE PA 16335

P.O. #

RE: ALLEGHENY CO. WHP

ACCOUNT NO. 00222

ANALYTICAL REPORT FORM

SAMPLE ID : SPRINGDALE
BAILED
06/21/95
LAB ID 50621139
DATE RECEIVED: 06/21/95

PARAMETER	RESULTS	UNITS	DATE AND	ANALYST
Solids,Dissolved	456	MG/L	06/26/95	BONANNO
Barium ICP (diss.)	0.04	MG/L	06/28/95	PRUTZMAN
Cadmium G.F. (diss.)	0.0005	MG/L	06/23/95	LIM
Chromium G.F. (diss.)	<0.001	MG/L	06/23/95	BAKER
Copper (dissolved)	<0.02	MG/L	06/23/95	KOZAKOVSKY
Lead G.F. (diss.)	0.001	MG/L	06/22/95	BAKER/ LIM
Nickel (dissolved)	<0.04	MG/L	06/23/95	KOZAKOVSKY
Iron ICP (diss.)	0.02	MG/L	06/26/95	PRUTZMAN
Manganese (diss.)	0.69	MG/L	06/28/95	KOZAKOVSKY

FREE-COL LABORATORIES, INC.
P.O. BOX 557,COTTON ROAD
MEADVILLE, PENNSYLVANIA 16335
PHONE: (814) 724-6242
FAX: (814) 333-1466

5815 AIRPORT ROAD
ROANOKE, VIRGINIA 24012
PHONE: (703) 265-2544
FAX: (703) 362-1663

07/07/95

TO:

MOODY & ASSOCIATES

R.D. #4, COTTON RD.
MEADVILLE PA 16335

P.O. #

RE: ALLEGHENY CO. WHP

ACCOUNT NO. 00222

ANALYTICAL REPORT FORM

PARAMETER	SAMPLE ID :	CORAOPOLIS BAILED 06/21/95	EDGEWORTH BAILED 06/21/95	SEWICKLEY BAILED 06/21/95
	LAB ID	50621133	50621134	50621135
	DATE RECEIVED:	06/21/95	06/21/95	06/21/95
VOLATILE COMPOUNDS	UNITS = MG/L			
TRICHLOROETHYLENE		<0.0005	<0.0005	<0.0005
CARBON TETRACHLORIDE		<0.0005	<0.0005	<0.0005
1,2-DICHLOROETHANE		<0.0005	<0.0005	<0.0005
VINYL CHLORIDE		<0.0005	<0.0005	<0.0005
BENZENE		<0.0005	<0.0005	<0.0005
P-DICHLOROBENZENE		<0.0005	<0.0005	<0.0005
1,1-DICHLOROETHYLENE		<0.0005	<0.0005	<0.0005
1,1,1-TRICHLOROETHA*		<0.0005	<0.0005	<0.0005
CIS-1,2-DICHLOROETH*		<0.0005	<0.0005	<0.0005
1,2-DICHLOROPROPANE		<0.0005	<0.0005	<0.0005
ETHYLBENZENE		<0.0005	<0.0005	<0.0005
CHLOROBENZENE		<0.0005	<0.0005	<0.0005
O-DICHLOROBENZENE		<0.0005	<0.0005	<0.0005
STYRENE		<0.0005	<0.0005	<0.0005
TETRACHLOROETHYLENE		<0.0005	<0.0005	<0.0005
TOLUENE		<0.0005	<0.0005	<0.0005
TRANS-1,2-DICHLORO*		<0.0005	<0.0005	<0.0005
XYLENE (TOTAL)		<0.0005	<0.0005	<0.0005
DICHLOROMETHANE		<0.0005	<0.0005	<0.0005
1,2,4-TRICHLOROBEN*		<0.0005	<0.0005	<0.0005
1,1,2-TRICHLOROETH*		<0.0005	<0.0005	<0.0005

Please reference the following page(s) for date and analyst.

*Some of the above names have been abbreviated. Please reference the enclosed list for their complete names.

ADVILLE DIVISION
A...H.A. Accreditation No. 98
U.S. Public Health Services Approved Facility
PA D.E.R. Laboratory I.D. No. 20-073
F Dept. of Agriculture Approved Dairy Laboratory
Dept. of Health Laboratory I.D. No. 10552
NY Dept. of Env. Conservation Approved Facility

ND Dept. of Health Cert. No. R-083
MD Dept. of Health Cert. No. 130
VA Dept. of Health Laboratory I.D. No. 00145
WV Dept. of Health Certification No. 9907C
NC Dept. of Natural Resources Cert. No. 236
MI Dept. of Public Health Approved Facility

ROANOKE DIVISION
VA Dept. of Health Laboratory I.D. No. 00143

FREE-COL LABORATORIES, INC.

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MEADVILLE PA 16335

P.O. #

RE: ALLEGHENY CO. WHP

ACCOUNT NO. 00222

ANALYTICAL REPORT FORM

PARAMETER	SAMPLE ID : / LAB ID / DATE RECEIVED:	ASPINWALL BAILED 06/21/95	HARMAR BAILED 06/21/95	CHESWICK BAILED 06/21/95
	LAB ID	50621136	50621137	50621138
	DATE RECEIVED:	06/21/95	06/21/95	06/21/95
VOLATILE COMPOUNDS	UNITS = MG/L			
TRICHLOROETHYLENE		<0.0005	<0.0005	<0.0005
CARBON TETRACHLORIDE		<0.0005	<0.0005	<0.0005
1,2-DICHLOROETHANE		<0.0005	<0.0005	<0.0005
VINYL CHLORIDE		<0.0005	<0.0005	<0.0005
BENZENE		<0.0005	<0.0005	<0.0005
P-DICHLOROBENZENE		<0.0005	<0.0005	<0.0005
1,1-DICHLOROETHYLENE		<0.0005	<0.0005	<0.0005
1,1,1-TRICHLOROETHA*		<0.0005	<0.0005	<0.0005
CIS-1,2-DICHLOROETH*		<0.0005	<0.0005	<0.0005
1,2-DICHLOROPROPANE		<0.0005	<0.0005	<0.0005
ETHYLBENZENE		<0.0005	<0.0005	<0.0005
CHLOROBENZENE		<0.0005	<0.0005	<0.0005
O-DICHLOROBENZENE		<0.0005	<0.0005	<0.0005
STYRENE		<0.0005	<0.0005	<0.0005
TETRACHLOROETHYLENE		<0.0005	<0.0005	<0.0005
TOLUENE		<0.0005	<0.0005	<0.0005
TRANS-1,2-DICHLORO*		<0.0005	<0.0005	<0.0005
XYLENE (TOTAL)		<0.0005	<0.0005	<0.0005
DICHLOROMETHANE		<0.0005	<0.0005	<0.0005
1,2,4-TRICHLOROBEN*		<0.0005	<0.0005	<0.0005
1,1,2-TRICHLOROETH*		<0.0005	<0.0005	<0.0005

Please reference the following page(s) for date and analyst.

*Some of the above names have been abbreviated. Please reference the enclosed list for their complete names.

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07/07/95

TO:
MOODY & ASSOCIATES
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MEADVILLE PA 16335

P.O. #
RE: ALLEGHENY CO. WHP
ACCOUNT NO. 00222

ANALYTICAL REPORT FORM

SAMPLE ID : SPRINGDALE
BAILED
06/21/95
LAB ID 50621139
DATE RECEIVED: 06/21/95

PARAMETER	RESULTS	UNITS	DATE AND	ANALYST
VOLATILE COMPOUNDS				
Trichloroethylene	0.0056	MG/L	06/23/95	MAJOR
Carbon Tetrachloride	<0.0005			
1,2-Dichloroethane	<0.0005			
Vinyl Chloride	<0.0005			
Benzene	<0.0005			
para-Dichlorobenzene	<0.0005			
1,1-Dichloroethylene	<0.0005			
1,1,1-Trichloroethane	<0.0005			
Cis-1,2-Dichloroethene	<0.0005			
1,2-Dichloropropane	<0.0005			
Ethylbenzene	<0.0005			
Chlorobenzene	<0.0005			
o-Dichlorobenzene	<0.0005			
Styrene	<0.0005			
Tetrachloroethylene	<0.0005			
Toluene	<0.0005			
Trans-1,2-Dichloroethene	<0.0005			
Xylene (Total)	<0.0005			
Dichloromethane	<0.0005			
1,2,4-Trichlorobenzene	<0.0005			
1,1,2-Trichloroethane	<0.0005			

Andrew K. Ecklund
ASST. LABORATORY DIRECTOR

FREE-COL LABORATORIES, INC.
P.O. Box 557, Cotton Road
Meadville, Pennsylvania 16335-0557
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FAX: Area Code 814/333-1466

ENVIRONMENTAL
OCCUPATIONAL HEALTH
FOOD SCIENCE
SPECIALISTS

REGULATED VOLATILE COMPOUNDS

Trichloroethylene

Carbon Tetrachloride

1,2-Dichloroethane

Vinyl Chloride

Benzene

p-Dichlorobenzene

1,1-Dichloroethylene

1,1,1-Trichloroethane

cis-1,2-Dichloroethylene

1,2-Dichloropropane

Ethylbenzene

Chlorobenzene

o-Dichlorobenzene

Styrene

Tetrachloroethylene

Toluene

trans-1,2-Dichloroethylene

Xylene

Dichloromethane

1,2,4-Trichlorobenzene

1,1,2-Trichloroethane

Moody and ASSOCIATES, Inc.

WATER AND EARTH SYSTEMS — CONSULTANTS AND DEVELOPERS

CHAIN OF CUSTODY RECORD 47

PROJECT: Allegheny Co. WHP

DATE: 6-21-95

BILL TO: ☐ CLIENT ☒ MOODY'S

Sample Description	How Collected	Date	Time	Collector
1. Coraopolis	bailed	6-21-95	1000	B. Miller/M. Miller
Parameters: See Attached List				
2. Edgeworth	bailed	6-21-95	1035	B. Miller/M. Miller
Parameters: See #1				
3. Sewickley	bailed	6-21-95	1115	B. Miller/M. Miller
Parameters: See #1				
4. Aspinwall	bailed	6-21-95	1250	B. Miller/M. Miller
Parameters: See #1				
5. Harmar	bailed	6-21-95	1315	B. Miller/M. Miller
Parameters: See #1				
6. Cheswick	bailed	6-21-95	1330	B. Miller/M. Miller
Parameters: See #1				
7. Springdale	bailed	6-21-95	1350	B. Miller/M. Miller
Parameters: See #1				
8.				
Parameters				
9.				
Parameters				
10.				
Parameters				

CHAIN OF CUSTODY

	Signature	Title	Organization	Inclusive Dates
1.	[signature]	Geologist	Moody's	6-21-95
2.	[signature]	Geologist	Moody's	6-21-95
3.	[signature]	C.S.	FCL	6/21/95
4.	Andrew Ecklund	Assistant Lab Director	[signature]	7/11/95

APPENDIX 6-D

Allegheny County Wellhead Protection Study
Locations of Supply Area Protection Signs

WELLHEAD PROTECTION SIGNS

The 11 proposed locations are indicated on the attached maps.

1. Edgeworth - on Route 65 South, heading into Edgeworth. "Water Supply Area Next 2 Miles - Spill Response 911"

2. Sewickley - Blackburn Road coming into Sewickley. "Water Supply Area Next 2 Miles - Spill Response 911"

3. Osborne - on Route 65 North, heading into Sewickley. "Water Supply Area Next 2 Miles - Spill Response 911"

4. Moon - on Route 51 South, heading toward Coraopolis. "Water Supply Area Next 2 Miles - Spill Response 911"

5. Moon - Thorn Run Road, down hill toward Coraopolis. "Water Supply Area Next 2 Miles - Spill Response 911". We should explore whether two small arrows, pointing both directions, can be added to the bottom of the sign.

6. Coraopolis - Route 51 North into Coraopolis, at Neville Bridge. "Water Supply Area Next 2 Miles - Spill Response 911"

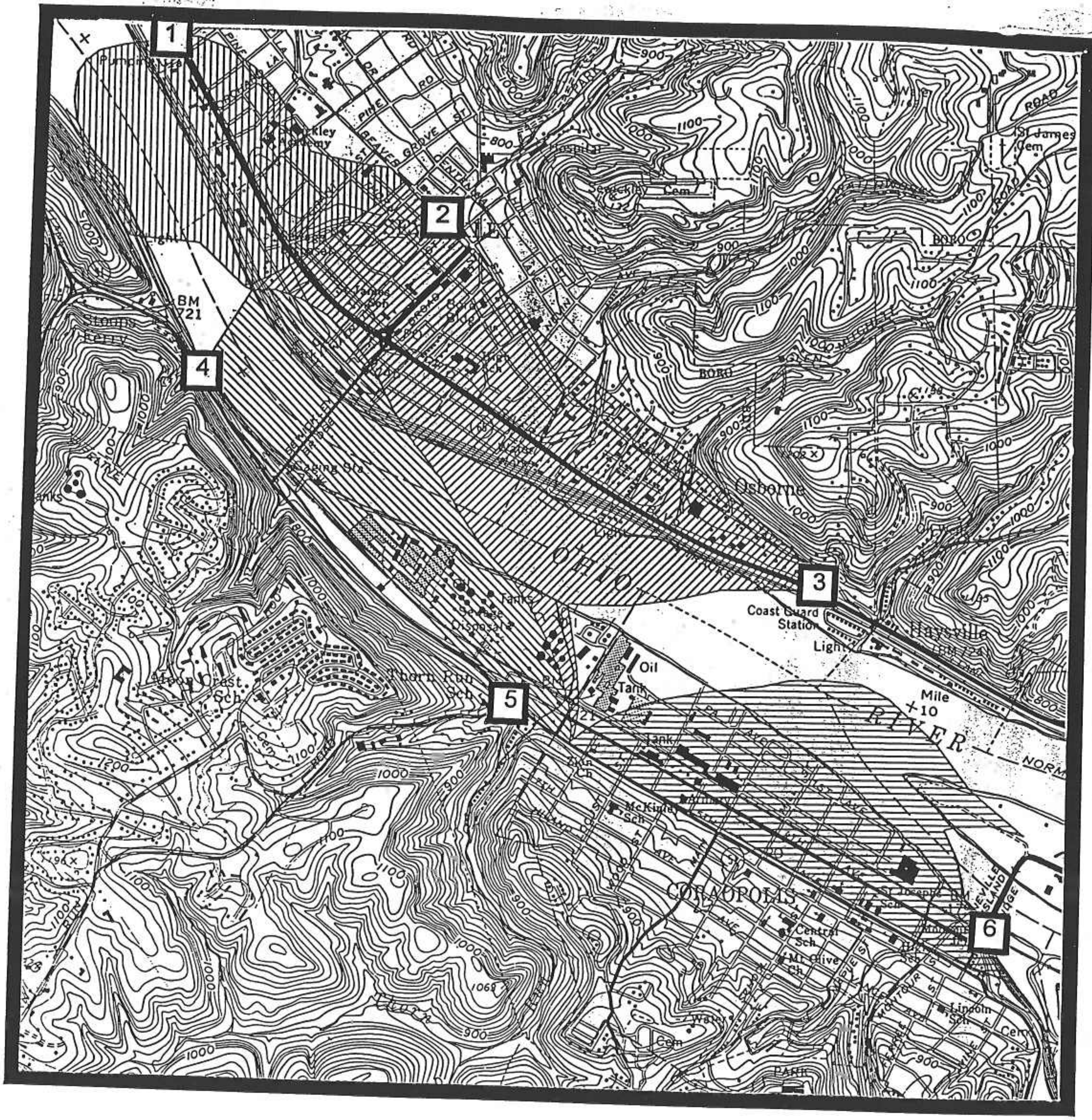
7. Springdale - On Pittsburgh Street (Freeport Road) at Butler Road, heading into the Borough. "Water Supply Area Next 3 Miles - Spill Response 911"

8. Harmar - Freeport Road under Turnpike, heading into Harmar. "Water Supply Area Next 3 Miles - Spill Response 911"

9. Etna/Shaler - Route 8 South, at intersection with Route 28. "Water Supply Area Next 3 Miles - Spill Response 911"

10. Etna - Route 28 North (across from Shaler Water Plant) "Water Supply Area Next 3 Miles - Spill Response 911"

11. Aspinwall - Route 28 South, across from Delafield Exit "Water Supply Area Next 3 Miles - Spill Response 911"



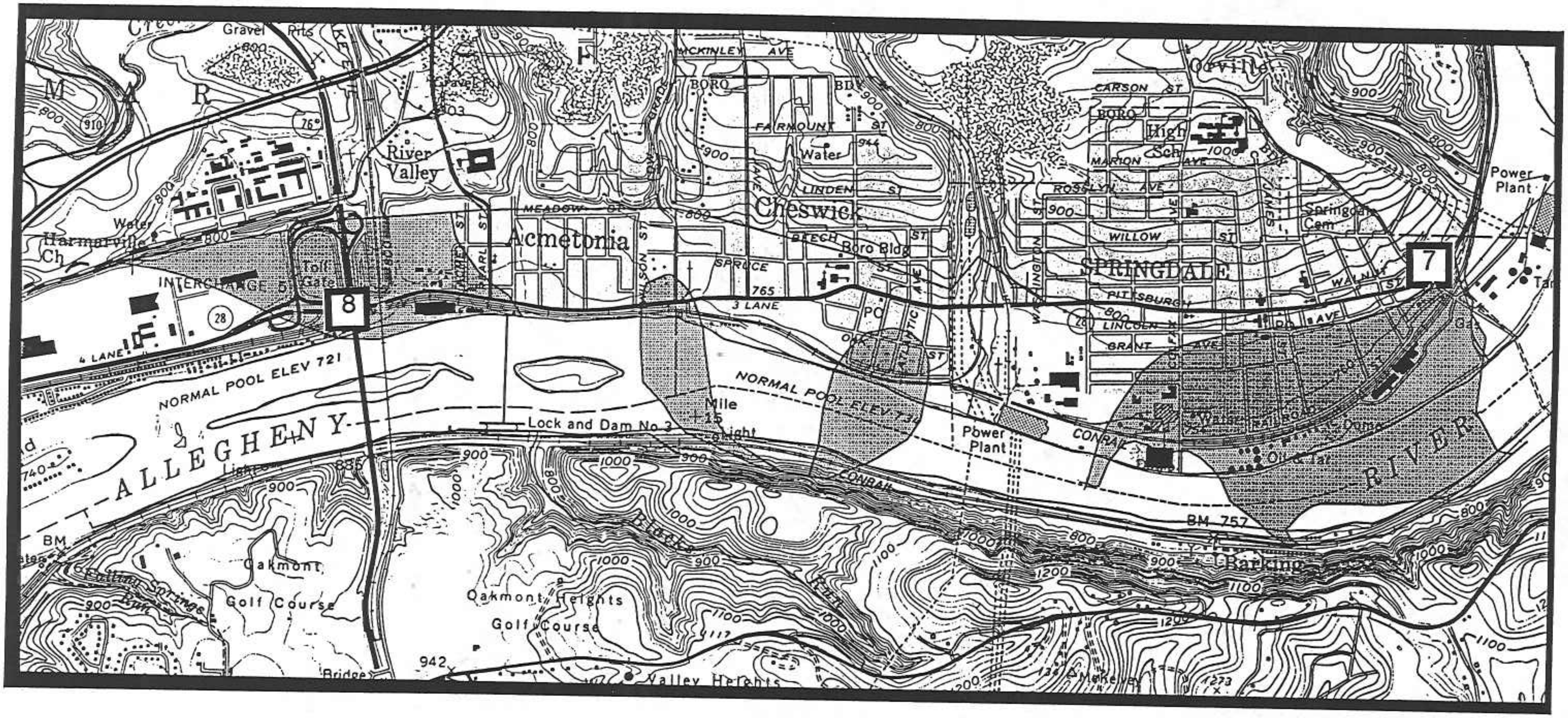
from Ambridge, PA USGS Quadrangle Map

WELLHEAD PROTECTION SIGN LOCATIONS FOR EDGEWORTH, SEWICKLEY, MOON AND CORAOPOLIS WELL FIELDS

- EDGEWORTH
- SEWICKLEY
- MOON TWP.
- CORAOPOLIS

SCALE: 1 inch = 2000 feet

NORTH



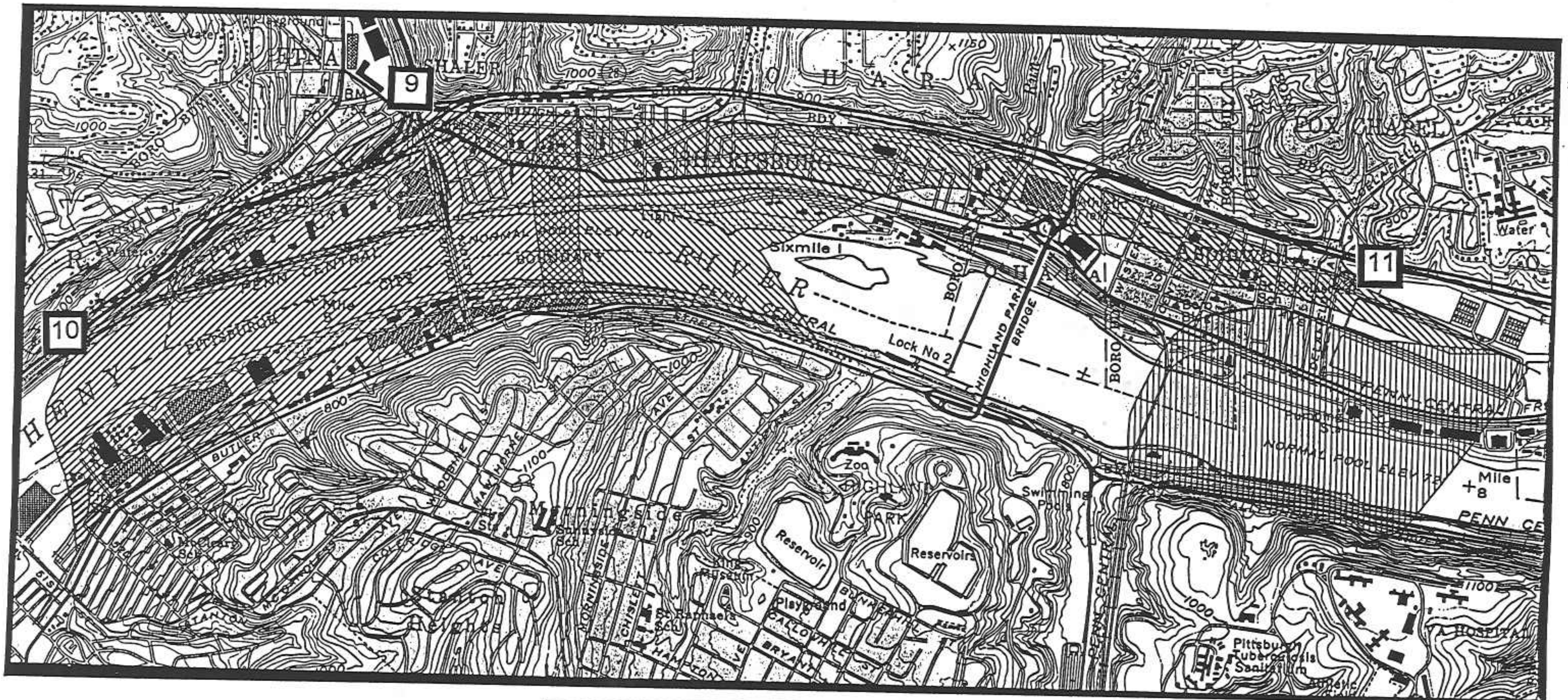
from New Kensington West, PA USGS Quadrangle Map

WELLHEAD PROTECTION SIGN
LOCATIONS FOR SPRINGDALE, CHESWICK,
HARMAR AND SAXONBURG WELL FIELDS

NORTH

SCALE: 1 inch = 2000 feet

WELLHEAD PROTECTION SIGN LOCATIONS FOR ASPINWALL, SHARPSBURG AND SHALER WELL FIELDS



from Pittsburgh East, PA USGS Quadrangle Map

NORTH

SCALE:
1 inch = 2000 feet

CAPTURE ZONE DELINEATION	
ASPINWALL	
SHARPSBURG	
SHALER	

7.0 CONTINGENCY PLANNING; NEW WATER SOURCE PROTECTION; PUBLIC PARTICIPATION

7.1 Contingency Planning

Information presented in this report has described the vulnerability to contamination of ground water in the sand and gravel aquifers which occur in Allegheny County.

Three potential contingency options are available to water systems in the study area which become faced with contamination of their ground water supply. These potential options include:

- Interconnection with an adjoining water system;
- Appropriate treatment to remove or reduce contaminants to acceptable levels;
- Installation of a new well.

The U.S. Army Corps of Engineers, Pittsburgh District, has completed an extensive "Allegheny County Emergency Water Supply Study" for the Allegheny County Planning Department (ACPD). This report and associated system hydraulic modeling forms the basis of contingency planning for interconnection of water systems throughout the County.

The reader is referred to the Corps of Engineers Study and the Allegheny County Health Department and Planning Department for more information concerning interconnection in the study area.

Water treatment may be a viable option for systems faced with ground water contamination. The most common and prevalent ground water contamination occurrence in the study area involves volatile organic compounds (VOC's) dissolved in ground water.

VOC contamination can be removed through use of activated carbon and/or air stripping. These treatment techniques, while effective, will require a significant cost for installation and maintenance. Also, a time period of several months up to several years may be required to build and put this type of treatment into operation.

The installation of a new well may be an option for remedying ground water contamination. However, careful geological studies will be required to assure that ground water contamination will not migrate to a new well. Also, considerable time (6 months to 1 year) and money ($50,000 to $200,000) will be necessary to put a new well into service.

7.2 New Source Protection

Development of a new ground water supply well requires extensive pre-planning and interaction with the Allegheny County Health Department and the Pennsylvania Department of Environmental Protection. A goal of this pre-planning is to provide new ground water source protection.

All permit applications for a new community water supply well must demonstrate that the water supplier owns or controls the Well Head Protection Area (WHPA) Zone 1, which will be a radius around the well of between 100 and 400 feet.

PA DEP regulations state the following regarding Well Head Protection Area Zone 1 requirements:

> *"After October 9, 1995, all construction permit applications accepted by the Department for a new or expanding community water system shall demonstrate the water supplier has ownership or substantially controls by a deed restriction or other acceptable means the WHPA Zone 1. This is to allow the water supplier to prohibit activities within Zone 1 which could have an adverse impact on source water quality or quantity. Furthermore, the water supplier must discontinue the storage, use or disposal of any potential contaminant within the WHPA Zone 1 except for chemicals used in the production or treatment of the drinking water. In addition, liquid fossil fuel storage is not allowed in the WHPA Zone 1 except for emergency power and heat for the water system and only where gas is not available. Under these conditions, liquid fossil fuel storage within the WHPA Zone 1 must be carefully contained above ground."*

Completion of WHPA delineations and potential contaminant inventories in this study along with recently adopted DEP new well permitting guidelines will form the basis for new source protection in Allegheny County.

7.3 Public Participation

Public participation is a key element in the well head protection process. Public participation and education have been undertaken throughout the project and these efforts will continue to be carried on by the Allegheny County Planning Department and Health Department.

Public participation in the project has included the following:

- An information exchange and kick-off meeting for all systems included in the study.
- A minimum of two site visits and meetings with each of the respective systems included in the study to obtain information on their well fields to identify potential contamination sources and to review results of well head protection delineations.
- Local cooperation in the installation of five (5) ground water monitoring wells at selected systems.
- Local cooperation in the location and installation of eleven (11) well head protection signs along major highway transportation routes in the study area.

In addition to the above efforts, the Allegheny County Planning Department and the Allegheny County Health Department will conduct three regional meetings to dispense information and results regarding the final program report and work plan.

8.0 SUMMARY

- Numerous municipal water systems which currently utilize or previously utilized wells, including the Boroughs of Blawnox, Springdale and Sharpsburg have experienced ground water contamination. All of the contamination incidents have resulted in hardship, inconvenience and additional costs for the water suppliers and their customers. A goal of the Allegheny County Wellhead Protection study is to avoid incidents of future contamination.

- Wellhead protection areas for eleven systems in Allegheny County were delineated in this study. Four of these systems are located on the Ohio River and seven systems on the Allegheny River.

- The wellhead protection areas delineated in this study were accomplished through the use of numerical models constructed to simulate the ground water flow systems of the Allegheny and Ohio river valleys. Several delineation methods were examined, with numerical models found to be the most applicable and rigorous for this study area given the complex aquifer boundary geometries, interaction of surface and ground waters, and the density of high capacity wells.

- The information used to construct these models has been taken from existing sources. The simulations are not an absolute determination of ground water flow within the valley-fill aquifers of the area. Numerical flow models require simplification of the actual system when constructing both the conceptual model and the numerical model, therefore, areas delineated by this method are approximations. In constructing the numerical models, conservative values for the aquifer characteristics were used. The resulting delineated wellhead protection areas are conservative in nature, potentially extending over a greater area than the actual zones of diversion.

- The delineated wellhead protection zones are extensive, in many cases extending across the entire valley fill aquifer. The extensive protection zones delineated in this study could not have been determined by the use of other delineation techniques such as analytical and semi-analytical modeling or calculated fixed radius. The basic assumptions of these methods would have resulted in much different determination of the wellhead protection zones. For example, the wellhead protection areas determined by numerical modeling for several well fields extend beneath the rivers to the opposite side of the valley fill deposits. None of the other methods of delineating protection zones could predict this flow system behavior.

- Potential contaminant sources which existed within wellhead protection areas were identified in the study. Due to the urban nature of the study area, many potential contaminant sources exist or did exist within the respective wellhead protection areas. The on going planning effort will include management techniques to avoid ground water contamination.

- Ground water monitoring wells were installed at five water systems as part of the Allegheny County Health Department's management approach to wellhead protection. These wells and two (2) additional existing monitoring wells were sampled to provide baseline ground water quality data for the respective systems. Annual sampling of the wells is recommended to continue to build on the baseline data base.

- The installation of eleven (11) wellhead protection signs along key transportation routes through WHPA's in the study area was completed as a management approach.

- These additional measures are being conducted or will be conducted by the Allegheny County Departments of Health and Planning to implement protection of ground water resources:

    - The Allegheny County model municipal ordinances will be modified as necessary to provide for consideration of Wellhead Protections Areas (Capture Zones) in zoning and land use decisions.

    - A model inspection ordinance will be developed to authorize municipalities and/or authorities to inspect facilities to identify and monitor the handling, storage and disposal of compounds which pose a contamination risk.

    - Three regional meetings will be conducted to dispense information and results regarding final program report and work plan.

    - A guidance document for implementing inspection programs will be prepared.

    - The initiation of first inspections at target sites will be undertaken.

- One round of inspections for each water supply will be completed.

- The delineated wellhead protection areas include predominantly developed, industrialized land use areas. The ongoing planning effort will continue with the goal to protect and monitor the ground water quality of the valley fill aquifers of Allegheny County.

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