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Cortland County Health Department

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February 2, 1989

Mr. Thomas C. Male, III
Regional Engineer
N.Y.S. Dept. Environmental Conservation
615 Erie Blvd. West
Syracuse, New York 13204-2400

Re: Remedial Investigation - Smith Corona

Dear Mr. Male:

On February 2, 1989, we met with Todd Miller and members of his staff to review their draft proposal. They were fearful of using certain terms in their proposal such as "remedial investigation" etc. We pointed out that this is, indeed, an offsite remedial investigation and they will draft their proposal accordingly. They hope to have the revised draft for our meeting next week, and infact they may have staff in attendance.

Very truly yours,

James V. Feuss, P.E.
Public Health Director

JVF:vnd
CC: Ron Heerkens
Enclosure

FEB - 3 1989

ESTIMATING ZONES OF CONTRIBUTION TO WELLS AND GROUND-WATER FLOW PATHS FROM CONTAMINATION SOURCES IN A GLACIAL AQUIFER AT CORTLAND, NEW YORK

PROBLEM

The glacial aquifers in Upstate New York are principal sources of water for many communities, but many aquifers are susceptible to contamination from a variety of sources because of their high permeability and the shallow depth to the water table. Potential contamination sources include: leaking petroleum-product storage tanks and pipelines, seepage of leachate from landfills and septic systems, road deicing salt, waste-product spills (such as solvents and degreasers) from commercial and industrial facilities and home-owners. Protection of these aquifers from contamination is critical, especially in areas of high water use and where there are no alternative sources of drinking water available at a reasonable cost. The movement and fate of known contaminants need to be tracked so that they do not adversely affect human health. Studies are needed to define the natural processes and those related to human activities that affect the flow regime and water-quality so that water managers will have a basis for implementing protective and remedial strategies.

The City of Cortland and surrounding villages are dependent on ground-water from one of the highly productive glacial aquifers in Upstate New York, the Cortland-Homer-Preble aquifer system. The aquifer has been designated by the New York State Department of Environmental Conservation as a "Primary Aquifer" (a geologic deposit yielding large quantities of water to a population of at least 20,000 people) and designated by the U.S. Environmental Protection Agency as a "Sole Source Aquifer" under the Safe Drinking Water Act. The aquifer is about 25 square miles and supplies drinking water to more than 35,000 people and to many commercial and industrial facilities.

Several parts of the aquifer have been contaminated by; (1) spillage of solvents and degreasers such as trichloroethylene (TCE), trichloroethane (TCA), and dichloroethylene (DCE), (2) seepage of bacteriological leachate from failing septic systems, and (3) leachate from other inactive hazardous waste sites. Although chlorides and nitrates generally meet state standards for drinking water, concentrations of these constituents have been progressively rising since the 1950's due to road salt deicing applications, lawn and garden fertilizers, and leachate from septic systems (Buller, 1978).

Water managers need to know ground-water flow paths to public-supply wells and from contamination sources in order to protect the water quality in the zones of contribution to wells and predict if and when contaminates may reach a well. Although previous work by the U.S. Geological Survey (Buller, Nichols, and Harsh, 1978; Reynolds, 1985) had constructed and modified a Trescott 2-D ground-water flow model (Trescott, 1975), the modifications to the program have made the model difficult to use and the grid design is not best suited for the key interest areas such as the major pumping wells and sources of contamination.

OBJECTIVES

1. Expand and refine knowledge of the hydrogeologic setting and flow regime of the Cortland aquifer. Emphasis will be in the west part of the aquifer where the stratigraphy is complex and least understood, the public water-supply wells are located, and the known contamination (TCE) has occurred.

2. Determine the extent of the TCE plume and the trends of several chemical constituents such as nitrates and chloride for which long-term data is available.

3. Determine if contamination has migrated from other inactive hazardous waste sites.

4. Estimate ground-water flow paths and equal travel times to public water-supply wells and from potential and known sources of contamination. Flow paths and travel times will be determined by using a 3-D ground-water flow model (McDonald-Harbaugh, 1983) and will incorporate a particle tracing routine (Pollock, USGS, Ground-Water Branch).

5. Transfer data and ground-water model to Cortland County computer system. Assist in the training of a county hydrogeologist to run the model.

APPROACH

1. Collect, compile, and analyze new data (well records, aquifer tests, and water-quality analyses) and refine conceptual model of the Cortland aquifer.

2. Transfer ground-water data bases that were used to construct the 2-D ground-water flow model to data files that will be used to construct a 3-D modular ground-water flow model (McDonald-Harbaugh, 1983). Redesign grid of model to best suit detail required near the major pumping wells and sources of contamination. The model will be installed on a SUN computer running the UNIX operating system to facilitate the transfer of the model to the county's computer which also uses a UNIX operating system. Preliminary calibration of the model will be for average-recharge, steady-state conditions.

3. Couple the particle-tracing program with the McDonald-Harbaugh ground-water flow model to make preliminary estimates of the zones of contribution to public water-supply wells and flow paths from known and potential sources of contamination. Based on existing data and preliminary modeling results, determine critical areas that warrant further investigations.

4. Install 2 continuous measuring water-level recorders to obtain detailed hydrographs that depict water-level fluctuations for the period of the study.

5. Conduct surface geophysics, such as seismic refraction and/or ground-penetrating radar to determine depth to water and bedrock. These surveys will be used to aid in the selection of optimum test-hole sites and, when used in conjunction with well logs, for constructing continuous geologic sections.

6. Conduct test drilling (total of 40 test wells)

   a. Drill 20 test holes to determine stratigraphy and water levels in the aquifer. About 13 will be in the west part of the aquifer to determine stratigraphy and water levels on the morainal area, where the geologic framework of the aquifer is complex and least understood, and where most of the public water-supply wells and contaminated areas are located. Fifteen of the test holes will be augered by the USGS rig and split-spoon samples will be collected and examined at 5 ft intervals. Five test holes will be drilled to bedrock (about 200-300 ft deep) using a cable tool rig. Two-inch diameter test wells will be installed in water-bearing zones penetrated by the augering and a set of shallow and deep wells will be installed in the holes drilled by cable tool. These nested piezometers will be used to determine heads at various depths in the aquifer.

   b. Install ten 2-inch diameter wells (using an auger rig) in zones of contribution to public water supplies that were preliminarily estimated by the particle tracing routine. The wells will be used for one or more of the following purposes: (1) observation wells for an aquifer test, (2) test wells for sampling ground water, and (3) calibration of the ground-water model.

   c. Install 10 two-inch diameter observation wells at potential hazardous-waste sites. At least one upgradient and one downgradient will be installed and water-quality samples (purgable organics, nutrients, and trace metals) will be collected and analyzed.

7. Measure water-levels monthly in observation wells to determine seasonal fluctuations of water levels and use it for calibration of the model.

8. Collect ground-water samples to determine whether contaminants are migrating from potential hazardous waste sites and to determine trends of several constituents that have been collected for several decades.

   a. Collect ground-water samples from about 50 wells and conduct preliminary qualitative analyses (screening) that will be done by a contractor lab (Chemistry Dept. at Cortland State College). Water will be analyzed for purgable organics (and trace metals and common ions and anions?). The preliminary screening will aid in selecting test hole sites to further define the extent of contamination.

   b. If significant amounts of contaminants are detected by the preliminary screening, follow-up samples will be collected from those and up to 25 wells and quantitative analyses will be conducted by the U.S. Geological Survey lab in Atlanta, Georgia. These samples will be analyzed for nutrients, common ions, trace metals, and purgable organics.

9. Incorporate the geologic and water-level data collected and analyzed during this study onto the ground-water model. Use the ground-water model to refine zones of contribution to public water-supply wells and flow paths from contamination sources. Transfer model to Cortland County.

10. Write report.

BENEFITS

This study will serve the goal of the Water Resources Division of the U.S. Geological Survey by providing geologic and hydrologic information that will contribute to the wise management of the nation's water resources including safety and well-being of the public. It addresses the priority issues for the Federal-State cooperative program such as concern over the quality of ground water. This study will define trends in water quality and study the movement and fate of contaminants in ground-water systems.

This study also provides scientific and technical assistance to the local government to manage its ground-water resource. Planners and water managers can use the information from this study to; (1) locate, design, and operate wells and water-treatment plants, and (2) develop strategies to protect the aquifer and plan remedial action should ground-water contamination threaten the water resource.

REPORTS

A Water-Resources Investigations Report (WRI) will be published at the end of the study (September 1992) and a calibrated 3-D ground-water flow model will be transferred to Cortland County. The report will be titled "Sources of water to public water-supply wells and water quality in the glacial aquifer at Cortland, New York."

MANPOWER

The project will require a full-time senior hydrogeologist to serve as project chief, a ground-water modeler (3/4 time), and a water-quality specialist (1/4 time). All are available in the Ithaca office.

COSTS

		FY 89	FY 90	FY 91	FY 92
1.	Collect, compile, and analyze new data to refine conceptual model of the ground-water system	$ 12,000	$	$	$
2.	Install and maintain 2 water-level recorders	1,500	2,000	2,000	2,000
3.	Transfer data bases from 2-D to 3-D model	5,000			
4.	Construct 3-D model including particle tracing routine	32,000	34,000	35,000	35,000
5.	Surface geophysics	10,000	15,000	8,000	
6.	Monthly water-level measurements of observation well network	1,000	3,000	4,000	3,000
7.	Test drilling - augering		23,000	25,000	6,000
	cable tool		15,000	15,000	
8.	Select and secure test hole sites, log wells, and levels to wells for elevation		13,000	13,000	4,000
9.	Aquifer tests		9,000	9,000	
10.	Collect and analyze water-quality samples (preliminary screening by Cortland State College)		4,000	4,000	
11.	Collect and analyze water-quality samples (USGS lab)		15,000	16,000	17,000
12.	Compile and interpret water-quality data	2,000	12,000	13,000	14,000
13.	Compile and interpret geologic and hydrologic data		18,000	18,000	18,000
14.	Report writing		15,000	15,000	33,000
15.	Supplies and equipment	4,000	10,000	10,000	3,000
16.	Vehicles	2,000	3,000	4,000	3,000
17.	Travel (meetings, conferences, training)	500	4,000	4,000	2,000
	SUBTOTALS	$ 70,000	$195,000	$195,000	$140,000
	TOTAL		$ 600,000		

INTRODUCTION

MODPATH is a three-dimensional particle tracking post-processing program designed to be used with output from steady-state flow simulations obtained using the USGS modular three-dimensional finite-difference ground-water flow model. MODPATH calculates three-dimensional path lines and (or) the position of particles at specified points in time based on starting particle locations selected by the user. The computer program MODPLOT generates graphical output from MODPATH output files. Both programs are written in FORTRAN 77. MODPATH references only standard FORTRAN 77 library routines, and, therefore, should run on any system with a FORTRAN 77 compiler. MODPLOT uses the DISSPLA graphics library subroutines, and can run only on systems that have access to the DISSPLA subroutine library.