Drinking Water Source Protection Report for the

Warren County – Franklin Area Public Water System

The Warren County – Franklin Area is a community public water system that voluntarily completed their drinking water source assessment under the Wellhead Protection Program. The Susceptibility Analysis was completed by Ohio EPA.

Susceptibility Analysis for the Warren County – Franklin Area (completed by Ohio EPA, 2003)

WHPP Submittal (completed by Camp Dresser & McKee, 1996)

ATTACHMENT A

Susceptibility Analysis, Protective Strategies and Proposed Consumer Confidence Report Language for Warren County North

Susceptibility Analysis:
The aquifer that supplies drinking water to the Warren County North's wellfield is highly susceptible to contamination. This determination was made because of the following reasons:

< The upper sand and gravel aquifer material is continuous to the surface with a depth to water of approximately 10 feet;
< The topography is relatively flat and the soils are sandy, allowing for a significant amount of precipitation to infiltrate into the ground instead of running off; and
< Potential significant contaminant sources exist within the protection area.

Water quality data collected to meet public water supply requirements provide a direct measurement for the presence of contamination in drinking water. Water quality data were evaluated using the drinking water compliance database available at the Ohio EPA. The available water quality data do not indicate that contamination has impacted the aquifer. Because sampling requirements are for treated water, the lack of water quality impacts is not a certain indication of the lack of contamination. This determination is limited by the sampling that is performed for the water system.

Warren County North has identified 24 potential contaminant sources that lie within the determined wellhead/source water protection area, eight of which are located within the inner management zone (or one-year time-of-travel zone). Some of the types of potential contaminant sources present are underground and above ground storage tanks, a gravel pit, railroads, a wastewater treatment plant, and commercial businesses.

Consequently, the likelihood that Warren County North's source of drinking water could become contaminated is high and it is critical that potential contaminant sources are handled carefully with the implementation of appropriate protective strategies.

Protective Strategies:
Protective strategies are activities that help protect a drinking water source from becoming contaminated or further contaminated. Implementing these activities can provide a number of long-term benefits, including protecting the health of the consumers; preserving water resources for future generations; avoiding the expense of cleaning up a contaminated water supply or finding alternative sources of water; and preserving or enhancing the economic value of the area by securing an abundant supply of clean water.

Warren County North outlined some protective strategies in the 1997 report *"Wellhead Protection Plan, North Water System Expansion"*, prepared by Camp Dresser & McKee.

Additional recommendations include:

Educational Outreach: Informing people who live, work, or own property within your protection area about the benefits of drinking water protection is very important. Although some communities develop their own educational outreach resources, assistance is available at no cost from various agencies. For example, staff from Ohio EPA's Office of Pollution Prevention can visit businesses (free of charge) and provide recommendations on how they can modify their processes, materials and practices to generate less pollution in a cost-effective and technically feasible manner. County agricultural extension agents, who are skilled at assisting farmers with technical issues, can provide advice on reducing the risk of contaminating the water supply (through proper application rates, enrollment in conservation reserve programs, and other management practices). Homeowners should also be made aware of the potential threat they can pose to the water supply. For more information on available brochures and educational information please contact the Wellhead/Drinking Water Protection staff at (614) 644-2752.

Zoning Ordinances: A water protection zoning ordinance is a regulatory control that typically places some restrictions or standards on activities conducted within a specified zone (in this case, the wellhead/drinking water source protection area). Warren County North may want to consider asking municipalities that are within the protection area (Carlisle, Franklin, and Middletown) to adopt Warren County's zoning overlay for portions of the protection area that are out of Warren County's jurisdiction. Since much of the land in the protection area is currently vacant, but zoned industrial, another option for Warren County North is to coordinate with the municipalities and determine if re-zoning land within the protection area - to a land use that poses less threat to the water supply - is possible.

Gravel Pit: Warren County North should consider working with the gravel pit owners to develop protection strategies and best management practices to reduce the risk of contamination from the gravel pit.

Warren County North should select protection strategies from the above listed recommendations and incorporate them into a drinking water source protection plan. A guidance document that describes how to develop a protection plan is attached to this letter.

Appendix B:

WHPP Submittal, Camp Dresser & McKee, 1996

Executive Summary

With the increasing discovery in many communities of groundwater contamination resulting from agricultural pesticides, leaking underground storage tanks, and industrial pollution, development of a pollution prevention program to protect groundwater has become vital. To combat this problem and provide the highest quality water possible for drinking and general municipal use with the greatest cost-effectiveness, steps need to be taken to eliminate, greatly reduce, and/or prevent groundwater pollution. The 1986 amendments to the Safe Drinking Water Act (SDWA) provided guidance to states to allow creation of local wellhead protection programs for this purpose.

In response, the Ohio Environmental Protection Agency (Ohio EPA) released the state's Wellhead Protection Program (WHPP) in May, 1992. Ohio's WHPP directs the owner and operator of a water supply, usually the local county, township, or municipal government, to develop and implement a WHPP and to take major responsibility, through land-use controls, for prevention of groundwater contamination.

Warren County is currently developing a new well field, located at the confluence of Twin Creek and the Great Miami River. Warren County has prepared this WHPP for the new water supply to comply with the state program.

This WHPP must be submitted to OEPA for review and approval prior to implementation. Upon approval by OEPA, the following steps will be taken to begin implementing the plan:

1. Pursuant to Resolution 93-294, establish Wellhead Protection Area for the enforcement of more stringent zoning and performance standards for the Wellhead Protection Area (WHPA) as suggested in Section 4 of this plan.

2. Coordinate with cities and townships within the WHPA. Request that they adopt a similar resolution to Warren County's.

3. Conduct an initial public meeting, and follow-up meetings as required, to present the findings and recommendations of the WHPP as part of the Public Participation Program.

4. Complete data gaps in pollution source inventory with assistance from appropriate agencies, public officials, and the general public as indicated in Section 3 of this report. Thereafter, update the inventory at least every three years, or more often if land uses change frequently.

5. Install fencing to limit access to the County controlled well field. Warren County will request private landowners to install fencing

around quarries and borrow pits surrounding the wellfield to deter vandalism and unauthorized dumping.

6. Install a system of seven groundwater monitor wells and one surface water monitoring station, and then begin implementation of groundwater monitoring plan as described in Section 5 of this plan.

7. Update the Water Supply Contingency Plan to include final design and operation of the new well field; addition of Resolution Number 93-294 to provide wellhead protection; and additional vulnerability analyses addressing updated potential pollution sources.

8. Appoint a representative from the Warren County Water & Sewer Department to coordinate with and assist the Warren County Emergency Management Agency in preparing an emergency plan as required by SARA Title III that will also address wellhead protection requirements.

9. OEPA controls upstream discharges to Twin Creek, the Great Miami River, and their tributaries that could affect the quality of water recharging the aquifer.

Section 1
Introduction

CDM has prepared this report to assist Warren County in creating and implementing an effective Wellhead Protection Plan (WHPP) for the new well field. The Ohio EPA's program requires that the plan include a number of elements, each of which is discussed in this report. These elements and the section which discusses each one are as follows:

1) The area to be designated as the wellhead protection area (WHPA), using one of the approved methods defined by Ohio EPA's WHP Program. Section 2 of this report addresses this element, using information provided by Civil & Environmental Consultants, Inc., (CEC), in the February 1995, report submitted to CDM. The CEC report discussed hydrogeologic parameters and models with respect to establishing wellhead protection area delineations.

2) A preliminary pollution source inventory which identifies past, present, and proposed land uses in the WHP area that may be contaminant threats to the well field. Land use, zoning, potential pollution sources and the one- and five-year time-of-travel (TOT) descriptions for the wellhead protection area are discussed in Section 3.

3) A management strategy that defines policies and procedures to prevent contamination. Pollution prevention and land-use controls are presented in Section 4.

4) An evaluation of the need for a ground water monitoring program. Section 5 presents recommendations concerning the needs involved in creating an effective Groundwater Monitoring Plan to monitor and protect the Warren County well field.

5) An emergency response contingency plan in the event of the occurrence of ground water contamination. Section 6 discusses the status of coordination efforts and needs for a contingency emergency response plan.

6) A public education/involvement program that educates and informs people of the WHP area and its needs is presented in Section 7.

7) Recommendations for work efforts leading to the implementation of a wellhead protection program are discussed in Section 8.

Section 2
Wellhead Protection Area Delineations

2.1 Introduction

As part of the Phase I preliminary engineering for the development of the North Water System Expansion for the Franklin-Lebanon Sewer District in Warren County, Ohio, the firm of Civil & Environmental Consultants, Inc. (CEC) was retained by Camp Dresser & McKee (CDM) to review and evaluate the existing hydrogeologic data and preliminary wellhead protection requirements for the proposed site. On December 15, 1992, CEC prepared a report of its findings, titled Hydrogeologic Report of Findings for Phase I —Preliminary Engineering, which was presented as "Appendix A" of CDM's Preliminary Design Memorandum: North County Water System Expansion, of February 10, 1993.

Based upon the findings, CEC's report recommended that groundwater flow modeling be performed to refine well yields, well spacings, and long-term impacts of well yield operation, including impacts on nearby domestic wells. The modeling should be selected, if possible, to assist in delineation of wellhead protection areas and the development of a wellhead protection plan.

In accordance with Ohio EPA WHP guidance, the criterion which CEC used to delineate the boundaries of the wellhead protection area was time of travel (TOT). The TOT area is that zone that is expected to contribute groundwater flow to wells or a well field within specified periods of time; times chosen for the North County well field were one year and five years. The reasons for this choice, as explained in the CEC report, were "the specific requirements of the amendment to the Warren County Rural Zoning Code, the various potential sources of impact identified, and the need for accurate and comprehensive criterion for delineating wellhead protection area boundaries." (1995, p. 20) These times are consistent with Ohio EPA's 1992 Wellhead Protection Program.

2.2 Results of Groundwater Modeling by CEC

In this section . . .

Subsequent to the preliminary findings discussed above, CEC was retained by CDM to perform the recommended groundwater modeling. A report titled, *Well Field Design and Wellhead Protection Areas: North Water System Expansion, Franklin Township, Warren County, Ohio*, was issued by CEC on February 15, 1995, and is included as Appendix A in this report. A summary of the findings of that report follows.

2.2.1 Well Field Description

The site proposed for Warren County's North Water System expansion is located on the northwest side of the Great Miami River approximately 2.5 miles west of Franklin, Ohio. A site location map is presented as Figure 2-1. A site plan, showing the locations of ten existing observation wells, one test well, one river stilling well, and six river well points, appears as Figure 2-2.

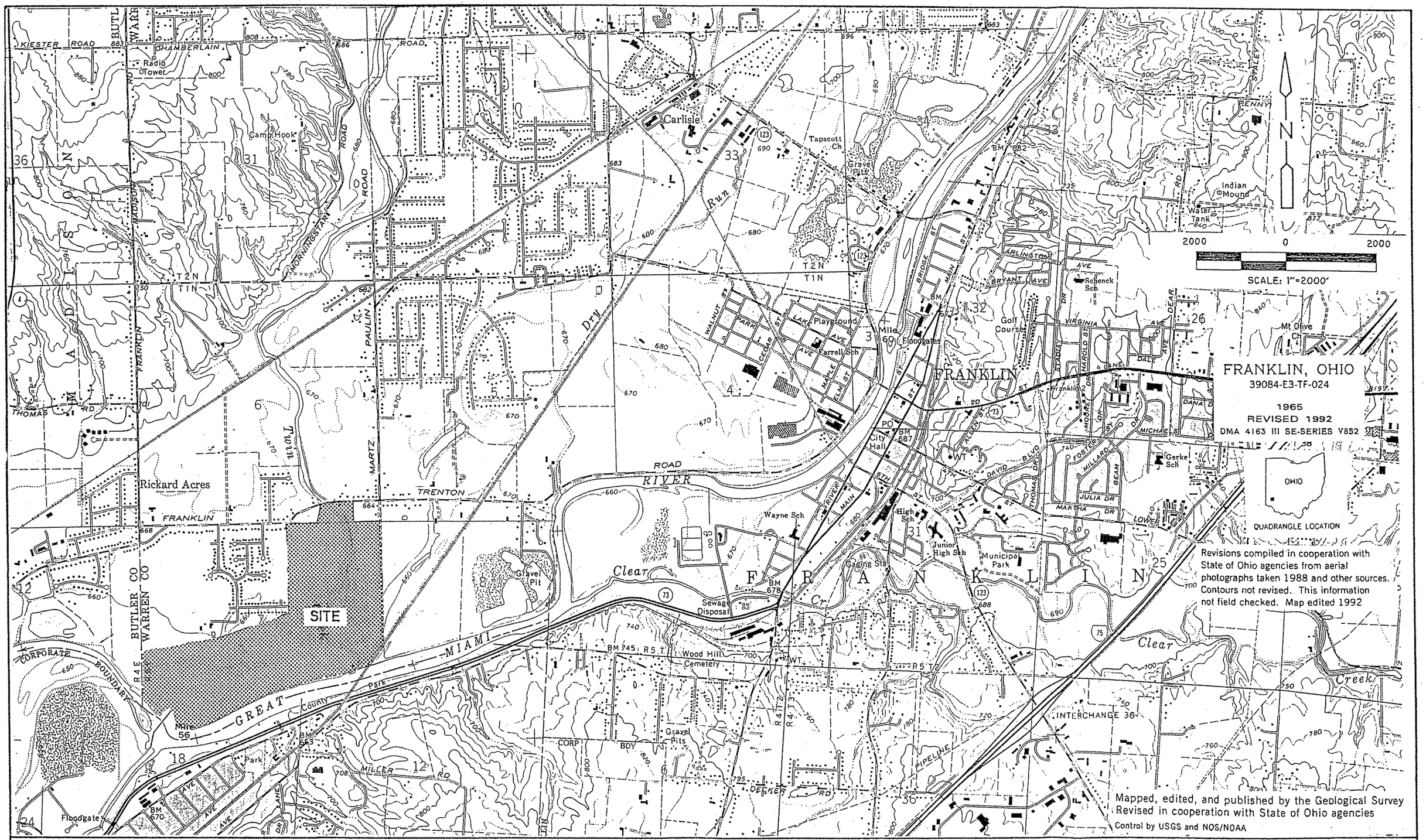
As these figures show, the Great Miami River serves as the southern border of the property containing the well field, and agricultural land borders the property to the east. The Warren-Butler County line provides its western boundary, and Dayton-Oxford Road serves as the northern border. Twin Creek, which flows from north to south, bisects a portion of the property, flowing from north to south, and discharges into the Great Miami River at the southern edge of the site.

The proposed site is currently owned by the Miami Conservancy District (MCD). Property to the east of the site is owned by individual property owners or by the American Aggregates Gravel Company. ConRail railroad tracks are located directly east of the site, and Baltimore-Ohio railroad tracks are located approximately one mile north. A residential area is located directly northwest of the site, and the Middletown landfill is located approximately 1.25 miles to the southwest.

2.2.2 Hydrogeologic Parameters

CEC performed a review of available hydrogeologic information for use in the development of a numerical groundwater flow model of the proposed well field site and surrounding area. This information included well completion logs, water level data, consultants' reports, and available published hydrogeologic information. CEC's summary of its hydrogeologic findings are presented below.

> The proposed well field site is located on the southern edge of the buried valley of the Great Miami River and is underlain by thick and extensive deposits of permeable sand and gravel. The buried valley is part of the Great Miami Buried Valley Aquifer System which was designated a Sole Source Aquifer by the U.S. EPA in 1988. Unconsolidated sand and gravel beneath the site ranges between 35 and 90 feet in thickness. Aquifer transmissivity in the central area of the site was calculated to be approximately 295,000 gpd/ft [gallons per day per foot].



NORTH WATER SYSTEM EXPANSION, FRANKLIN TOWNSHIP, OHIO

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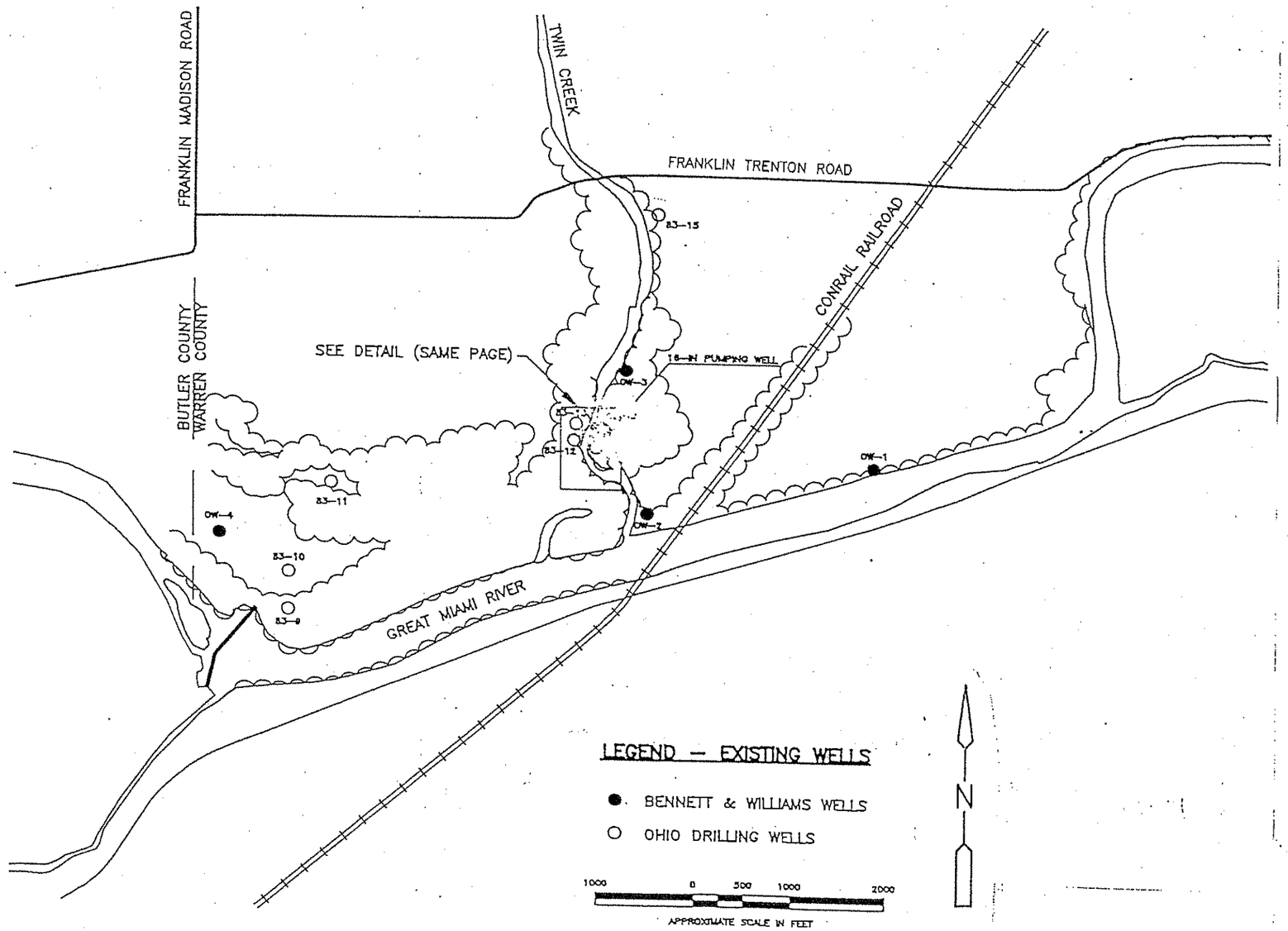
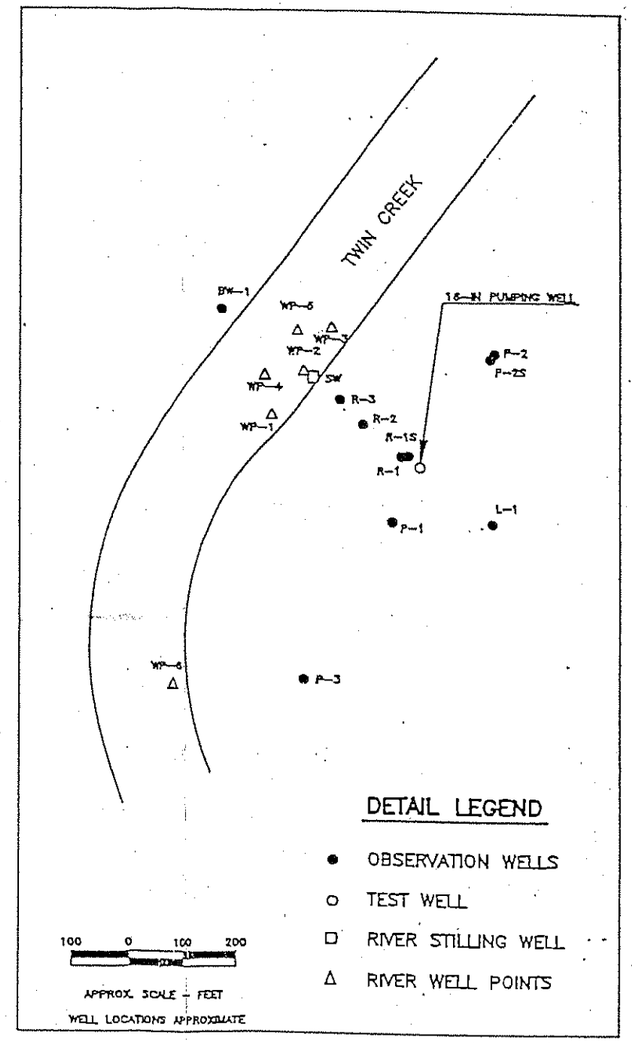
SITE

FIGURE 2-1



Adapted from Bennett & Williams, 1990a, 1990b



NOTE: BASE MAP MODIFIED FROM CEC'S "WELLHEAD DESIGN AND WELLHEAD PROTECTION AREAS, NORTH WATER SYSTEM EXPANSION FRANKLIN TOWNSHIP, WARREN COUNTY, OHIO" REPORT OF JULY 2, 1993, FIGURE 2

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NORTH WATER SYSTEM EXPANSION, FRANKLIN TOWNSHIP, OHIO

SITE PLAN

FIGURE 2-2

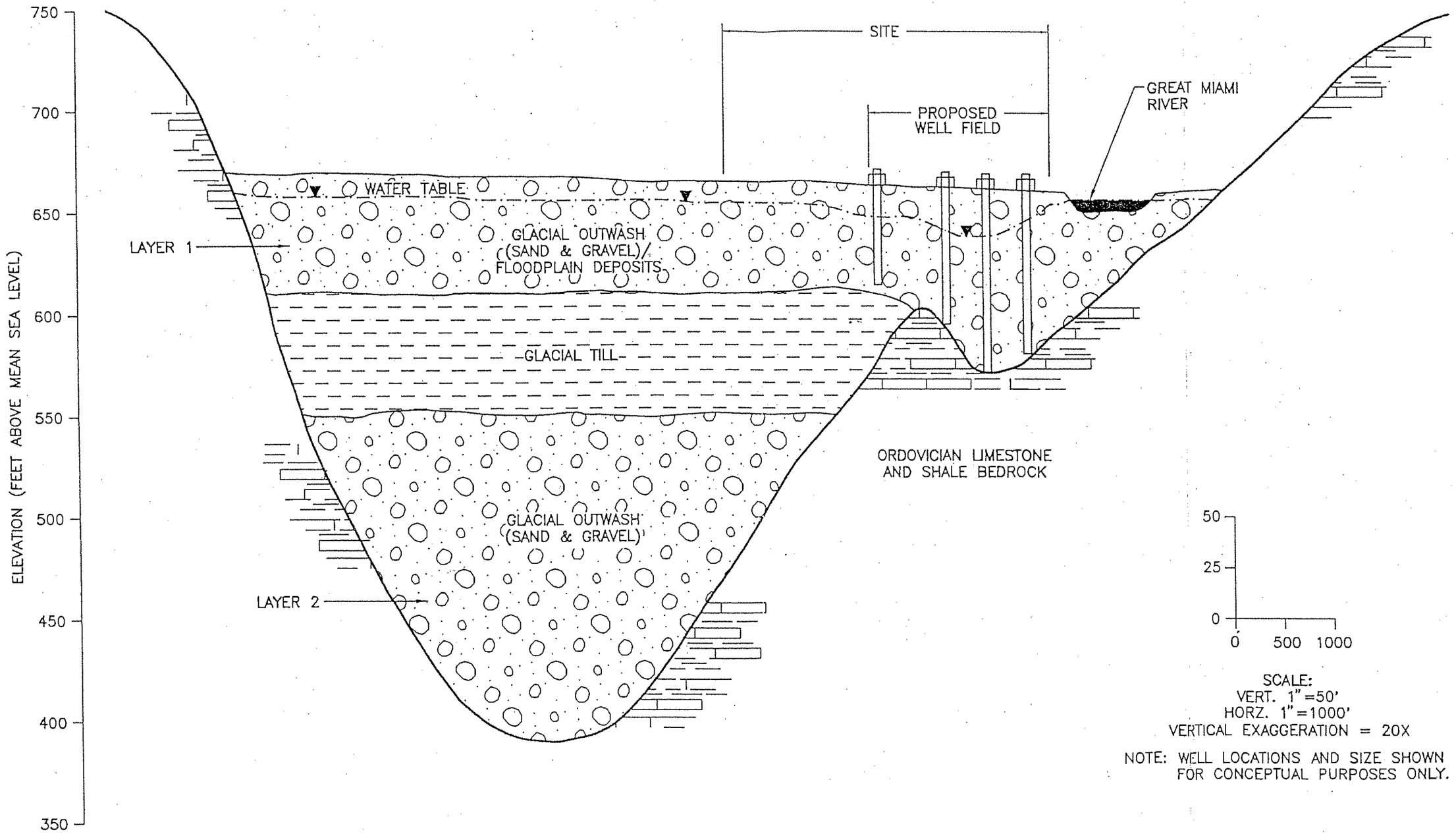
Hydraulic conductivity values for the site range between 900 and 7,000 gpd/ft^2, with an average of 3,500 gpd/ft^2 (468 ft/day). There is high potential for good hydraulic communication between the aquifer and surface waterways such as Twin Creek and the Great Miami River. (1995, p.28)

The production wells will be completed exclusively in the upper aquifer as depicted in **Figure 2-3**.

2.2.3 Model Selection and Calibration

CEC performed groundwater flow modeling as part of its review and evaluation of the proposed well field site; the procedures used in the modeling process were discussed in Section 3.0 of CEC's report and summarized in Section 5.0 of that report as follows:

> Groundwater flow modeling was performed to evaluate well field yields, production well spacing, and long term impacts of well field operation, including impacts on nearby domestic wells. Groundwater flow modeling was performed using MODFLOW, a finite difference numerical model. The hydrogeologic system was modeled using a variable-spaced finite-difference grid and included a two-layer sand and gravel aquifer system separated by a till confining layer. [Note that this configuration was suggested by the geologic logs available for local wells.] The model was calibrated under steady-state conditions and the calibrated model was subjected to verification and sensitivity analysis. Sensitivity analysis indicated simulated hydraulic heads to be most sensitive to values of river conductance and hydraulic conductivity, with river conductance values having the greatest degree of uncertainty. (1995, p. 29) [Note that there is a high potential for good hydraulic communication between the aquifer and surface waterways such as Twin Creek and the Great Miami River.]
>
> As indicated on pages 10-11 of the CEC report, which is included in Appendix A, a composite potentiometric map for use in model calibration was developed from the best available sources including maps and local well logs. Model calibration and sensitivity analysis is presented on pages 12 through 15 of the CEC report. As mentioned in the report (pages 19, 22), hydraulic heads simulated under steady-state conditions with a reduced river conductance (i.e., reduced river recharge) at a well yield of 8 MGD were used as a conservative approach during particle tracking analysis. This resulted in higher rates of travel times for individual particles and a larger wellhead protection area. In addition, a conservative monitoring program is proposed which involves several shallow and deep monitoring wells surrounding the well field.
>
> Elevations were obtained from maps during the model setup and calibration process as discussed above and in the CEC report. Potential errors associated with this and other modeling assumptions were taken into account during the model calibration, verification, and sensitivity analysis process.



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HYDROGEOLOGIC CROSS SECTION SHOWING LOCATION OF PROPOSED PRODUCTION WELLS

FIGURE 2-3

For example, calibration targets are listed on pages 12-13 of the CEC report. Assumptions associated with reduced river conductance, as discussed above, have been employed to provide a conservative estimate of the boundary of the wellhead protection area. In addition, a conservative monitoring program is proposed.

2.2.4 Results of CEC's Groundwater Modeling

Using the calibrated model, CEC performed simulations using scenarios of projected water demands. Model results were analyzed for two purposes: to determine effects of the projected demands on well field yields and, using simulated hydraulic head conditions and a particle-tracking feature of the model, to identify and establish the boundaries of the wellhead protection areas. The following paragraphs present CEC's summary of its analysis of modeling results and conclusions drawn from that analysis. The first paragraph identifies the results of the yield analysis; the second identifies wellhead protection boundaries as established by particle tracking, and the third discusses the wellhead delineation based on production rates.

> Predictive simulations were performed for the 19-year time period between 1995 and 2013 to evaluate changes in groundwater levels in response to average future demands of 3.0, 5.0, 7.0, 9.0, and 11.0 million gallons per day (MGD). A comparison of predicted drawdown at 70 percent well efficiency with estimated values of maximum available drawdown indicates that the production well spacings of 500 feet are adequate and conservative for future well field development. Remaining available drawdown ranged from approximately 30 to 50 feet for the majority of production wells at well field yields of 3.0 through 9.0 MGD. Similar results were obtained for a well field yield of 11.0 MGD. except for wells in the west portion of the site which showed remaining available drawdown values of 10 to 15 feet. However, it is likely that adjustments to individual pumping rates could be performed so that none of the wells would exceed safe pumping levels. Assuming no other production wells or well fields other than those included in the model, predictive modeling indicates that the well field could be developed to produce an average yield of 8.0 MGD, with increases of up to 11.0 MGD. (1995, p. 29)
>
> Forward particle tracking analysis was also performed for a well field yield of 3.0 and 8.0 MGD to evaluate time-of-travel and direction of migration of simulated contaminants from potential source areas to the well field. Potential sources of pollution identified include the ConRail railroad tracks, the American Aggregates Gravel Pit, and the Franklin wastewater treatment plant located east of the proposed well field. Also included were the Baltimore-Ohio railroad tracks to the north of the well field and the Middletown landfill to the southwest. At 3.0 MGD, the two southernmost wells of the well field appear to be the most vulnerable with particles from the ConRail tracks reaching these wells within a 6- to 9-month time frame and particles from American Aggregates reaching these wells within a time frame of a little over 2 years. At 8.0 MGD, the two proposed production wells on the southeast corner of the property were

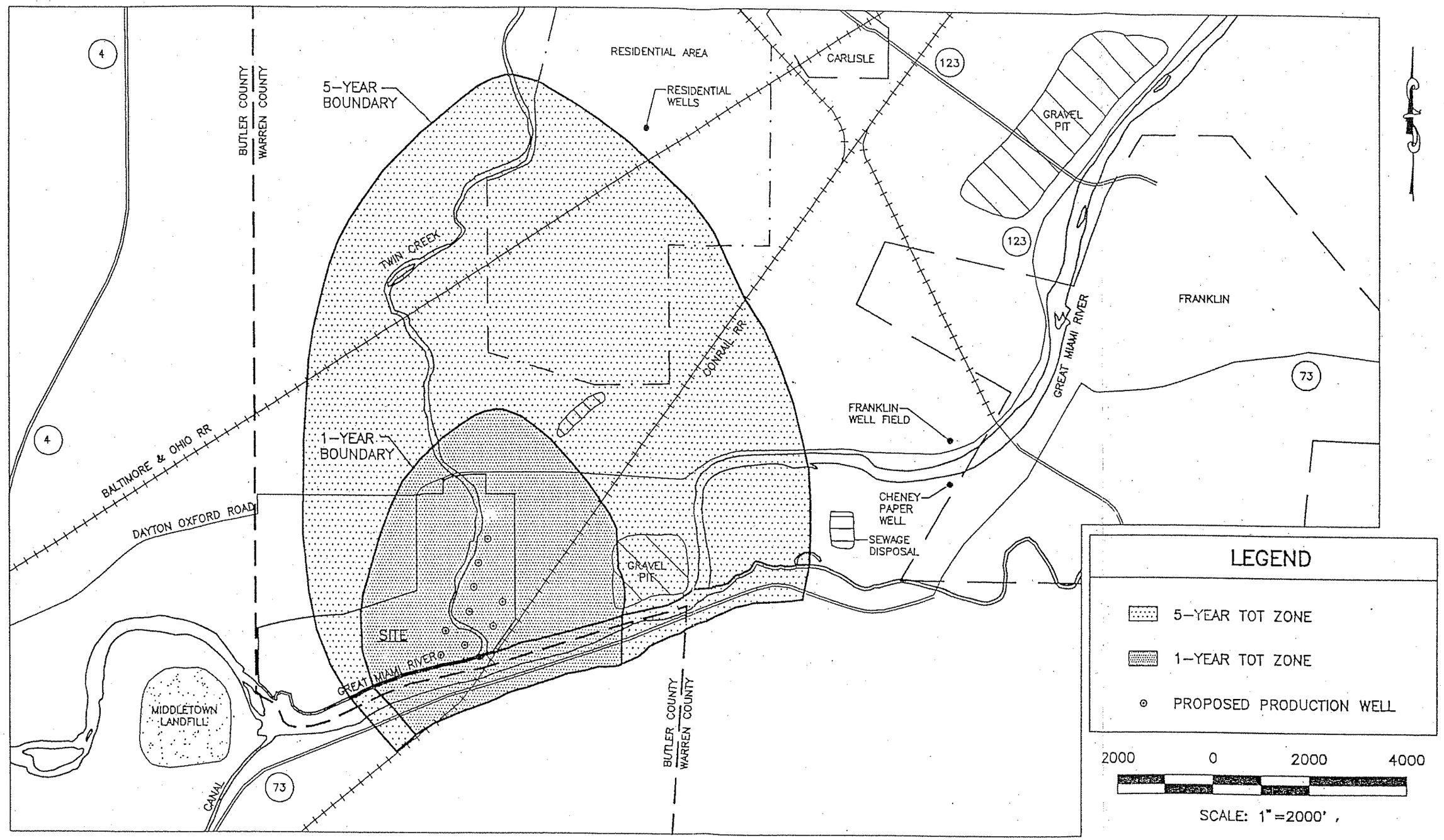
> identified as being the most vulnerable, with particles from the ConRail tracks reaching these wells within a time period of less than 3 months and particles from American Aggregates reaching these wells within 9 months to 1 year. Forward particle tracking analysis also indicated that particles from the Baltimore-Ohio railroad tracks reach the northern proposed production wells within a 3- to 5-year time period, depending on well field yield. Particles from the Franklin wastewater treatment plant and the Middletown landfill did not reach the proposed well field under the conditions simulated at 3.0 and 8.0 MGD. The analysis also indicated that the vulnerable wells could be used, if necessary, to capture contaminants from source areas in order to protect the rest of the well field. (1995, p. 30)
>
> The delineation based upon 8 MGD is currently proposed for the WHP Plan. The wellhead protection area delineation would be reevaluated prior to nearing the 8 MGD limit. This reevaluation will be based on additional exploratory drilling and the current production well configuration and future proposed configuration. Following startup of the well field at 3 MGD, drilling, water level and pumping test information can be used to refine the conceptual and numerical model, as needed, to provide predicted drawdown and particle-tracking results for expansion of the wellfield to 8 MGD or greater. Depending on actual aquifer response and surface water recharge, there may be no need for the westernmost wells which would reduce the potential for impact from the Middletown landfill.

Since the original model was prepared, three of the wells have been drilled. Locations for two of the three wells varies from the original model by 60 to 300 feet. The locations of future wells necessary to achieve the 7.0-8.0 MGD levels (used for delineaton and particle treating) are expected to be similar to the original groundwater model. Therefore, the initial one year and five year TOT delineations are considered to be appropriately accurate for this initial delineation.

Results of groundwater monitoring will be used to refine the model and will assist in determining whether additional monitoring wells will be needed as the production capacity increases to the 7.0-8.0 MGD range. For example, areas of future concern such as monitoring for effects of the Middletown Landfill, can be addressed based on refined model results. For additional discussion of monitoring plan see Section 5.4.

2.2.5 One- and Five-Year TOT WHPA

CEC's groundwater modeling allowed for the delineation of one- and five-year TOT zones around the new well field, as desired by the Ohio EPA. The south side of the Great Miami River, including Route 73, has been incorporated into the wellhead protection area. The 1-year and 5-year TOT zones and wellhead protection area has been extended to the bedrock-alluvium contact along the valley wall of the Great Miami River. The boundaries of these zones are displayed in Figure 2-4.



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1 YEAR AND 5 YEAR
TIME-OF-TRAVEL BOUNDARIES
AND PSI SITE LOCATIONS

FIGURE 2-4

Section 3
Preliminary Pollution Sources Inventory

3.1 Introduction

As the Ohio EPA's Wellhead Protection Program directs, an inventory of potential sources of groundwater contamination in and around the wellhead area must be prepared as a necessary component of the program. The purpose of the inventory is to document past, present, and potential activities that could put the well field at risk. This section of the report identifies and discusses the potential sources of contamination. The Warren County Buiding Department administers all building permits for the Village of Carlisle and the unincorporated areas of Franklin Township. Arrangements will be made to receive copies of all building permits issued within the area to allow us to automatically update the Preliminary Pollution Sources Inventory (PSI). Existing structures and the PSI will be reviewed and updated every three years.

3.2 Description of Land Use

The wellhead protection area (WHPA) exhibits a variety of land uses. Some land uses within the WHPA represent possible existing and future threats of contamination to the groundwater system. In order to identify potential sources of both point and non-point pollution, the land uses in the wellhead protection areas were evaluated and categorized by CDM. CDM obtained land use information from agencies including the Warren County Zoning Department and Health Department and the Cities of Carlisle and Franklin, Ohio. Land use in the wellhead protection area was classified and mapped using 1977 aerial photography and on-site visual inspections via a windshield survey of readily visible characteristics of the WHPA. Existing land uses were categorized as one of the following:

- Single-family residential
- Two-family residential
- Multi-family residential
- Commercial/retail
- Industrial
- Agricultural
- Vacant

In this section . . .

In general, higher densities of development in a wellhead protection area provide greater challenges to protecting groundwater quality and also to maintaining the quantity of water recharged. Residential land uses may potentially introduce contaminants to groundwater from lawn fertilizers and pesticides, oil and grease from automobiles, faulty septic

systems, and leaking heating oil tanks. Higher density zoning may reduce possible contamination from lawn care (by reducing landscaped areas) but may increase possible contamination associated with road and parking area runoff. Moreover, higher density land use and zoning increases impervious surface which in turn usually reduces groundwater recharge.

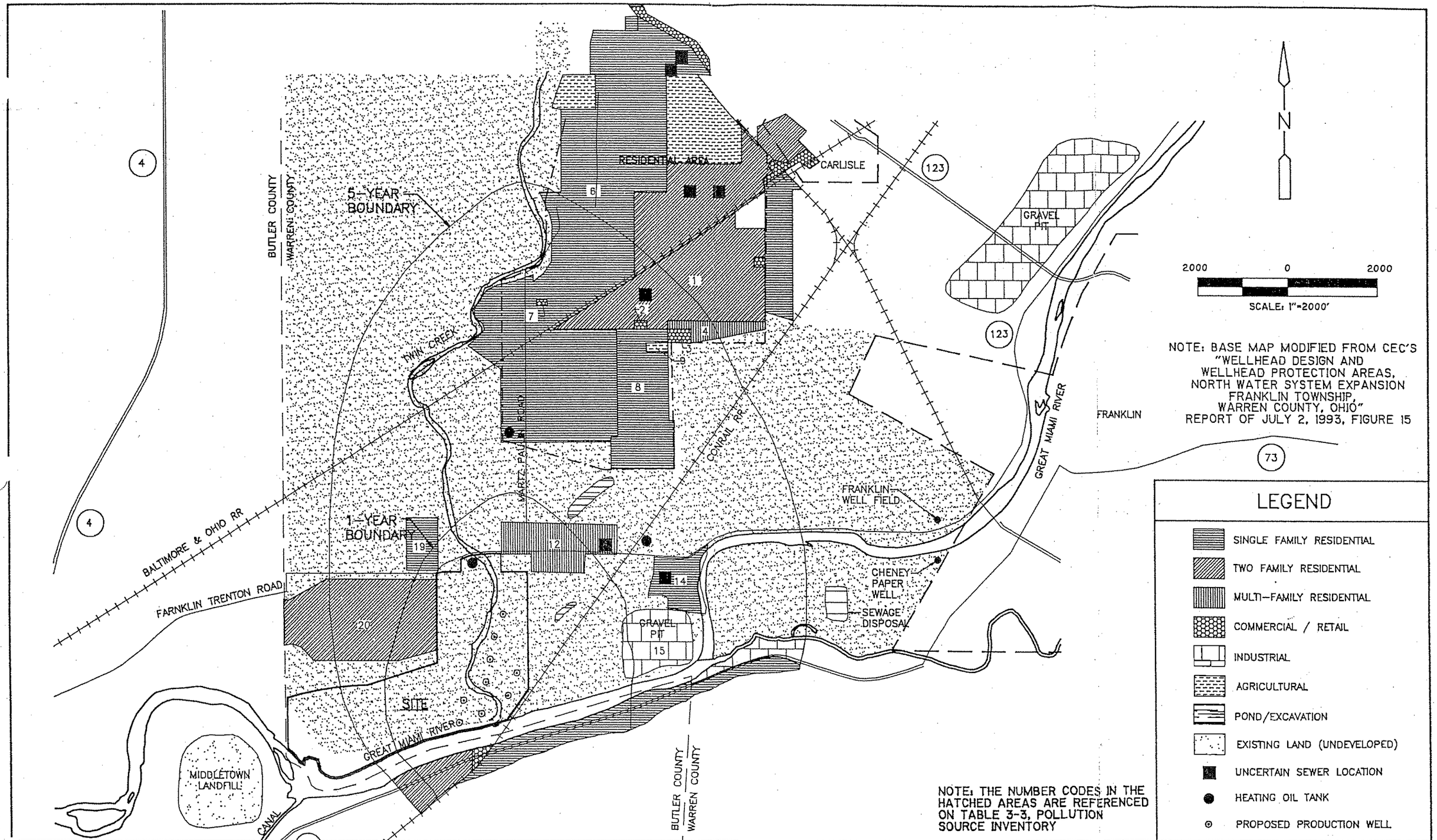
Industrial activities within wellhead protection areas are possible sources of groundwater contamination because businesses may manufacture, use, and store hazardous substances. Hazardous materials, whether from industrial or residential sources, threaten groundwater if they are released from proper on-site storage or if they are incorrectly handled. Therefore, government and industries must work together to properly store, handle, and dispose of hazardous substances.

Agricultural areas, like residential lawns, are sources of potential groundwater pollution from fertilizers and pesticides. In such areas, if chemicals are applied strictly in accordance with manufacturer recommendations, the potential for groundwater pollution can be minimized. However, as with residential landowners, farmers can be prone to over-application of chemicals and thus can contribute to groundwater contamination.

Land occupied by stormwater detention basins and other standing surface water bodies may tend to seem innocuous. However, water detention/retention basins tend to concentrate water-borne contaminants present in stormwater, and pollutants are carried by non-point source runoff into surface water. Thus, even land covered by water can be a source of pollution via groundwater recharge. Two small ponds exist within the five-year TOT area. Thus, the possible impact of standing surface water on the well field must be considered and is discussed in Section 3.3, below.

Finally, vacant land within wellhead protection areas provide important opportunities for water to recharge and filter naturally through the soil. Note that, if such vacant areas are public lands, such as parks and recreations areas, they will most likely serve this function well into the future. However, vacant private land always has the potential to become developed; the zoning of this land thus controls possible future pollution sources.

The existing zoning and land uses of the WHPA have been delineated by CDM by evaluating municipal zoning ordinances and the accompanying zoning maps. Figures 3-1 and 3-2, on the following pages, show the existing land use and vacant land use, respectively, for the one-year and five-year TOT boundaries. Table 3-1, which follows the figures, shows the components and approximate acreage of existing land use and vacant land use for the one- and five-year TOT boundaries.



NORTH WATER SYSTEM EXPANSION, FRANKLIN TOWNSHIP, OHIO

EXISTING LAND USE WITH 1-YEAR & 5-YEAR TIME-OF-TRAVEL BOUNDARIES AT WELL FIELD YIELD OF 8 MGD

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3-1

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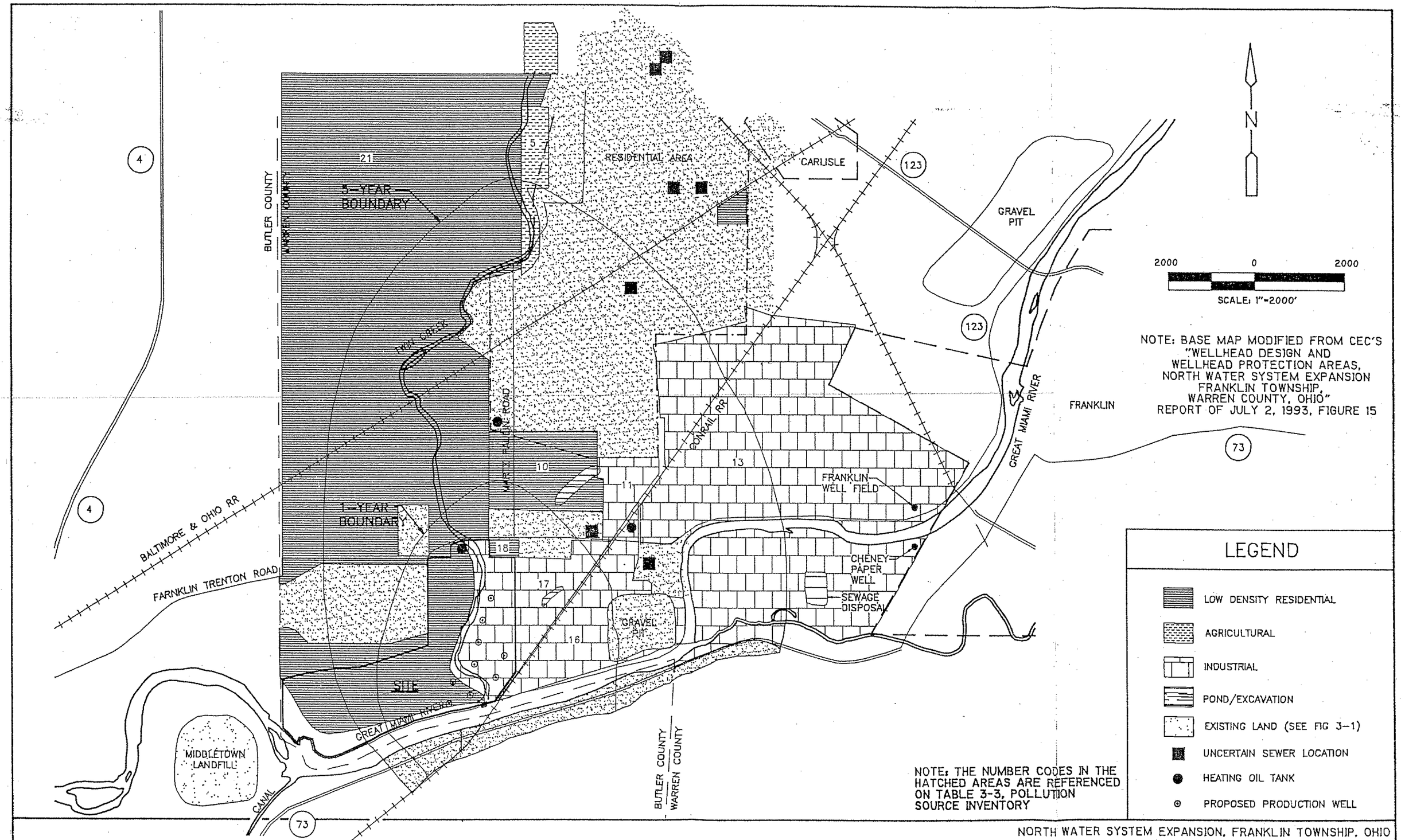

NORTH WATER SYSTEM EXPANSION, FRANKLIN TOWNSHIP, OHIO

VACANT LAND WITH 1-YEAR & 5-YEAR TIME-OF-TRAVEL BOUNDARIES AT WELL FIELD YIELD OF 8 MGD

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upstream along the Great Miami River. If upstream discharges or spills occur into either/ both Twin Creek or the Great Miami, groundwater contamination could result due to induced recharge to the aquifer. This may provide a problem for adjacent groundwater sources.

3.3 Pollution Sources Based on Land Use

In addition to identifying land use and zoning, the CDM staff conducted a comprehensive inventory of hazardous and potentially hazardous sites in Warren County. This inventory consisted of a regulatory database review, interviews with public officials, and windshield surveys. Potential sources include: locations of known or suspected hazardous waste; NPDES permit locations; and locations where day-to-day activities, without proper precautions, could potentially lead to discharge of hazardous materials. These could include gasoline/oil storage locations, unsewered areas, stormwater detention basins, or water wells.

CDM directed Vista Environmental Information, Inc. (Vista), to conduct a regulatory database review by zip code to search for actual and potential sources of hazardous sites within the WHPA. Vista's search encompassed an area one mile in diameter, which was somewhat synchronous with the one-year TOT area within the WHPA. The following databases were searched:

- National Priority List (NPL)
- Facility Index System (FINDS)
- Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS)
- Resource Conservation Recovery Act (RCRA) Notification System
- Solid waste facilities not in compliance with RCRA Subtitle D criteria (open dump site)
- Emergency Response Notification System (ERNS)
- State Priority List
- State solid waste facilities information

Vista's electronic database search, presented in Appendix B, found no federal or state records of hazardous waste sites within the one-year TOT. Information from the Emergency Response Notification System (ERNS) listed four oil or hazardous substance releases within the 45005 and 45042 zipcodes. However, none of these were located within the WHPA. Finally, a site reconnaissance was conducted to support CDM's February, 1993, Preliminary Design Memorandum to inquire into the status of several hazardous waste sites which had been mentioned in the regulatory responses. These included the Franklin WWTP, the Systech Liquid Treatment Corporation, and the Butler County/Middletown Landfill. The first two are located near the eastern edge of the five-year TOT

and are upgradient of the well field; Ohio EPA showed no mention of either facility in its regulatory records; however, they indicated that the Systech facility appears on the U.S. EPA Superfund list. The landfill is located to the west and downgradient of the WHPA and does not appear in regulatory records.

In addition to the database search conducted by Vista, several local and state agencies were consulted, and the WHPA was observed during a windshield survey conducted on July 8, 1993 and again on March 5, 1995, to obtain additional information about possible sources of hazardous waste. A variety of information was received from these sources and is summarized below:

- CDM requested and received a listing of all registered underground storage tanks, violation notices or releases within the 45005 and 45042 zip code areas from the Ohio State Fire Marshall's Bureau of USTs. The list presents known locations that store gasoline or oil for the above noted areas. Such facilities usually have an underground storage tank(s) and regularly transfer the fluids between the UST and vehicles. These facilities are possible sources of groundwater contamination from leaking tanks and spilled gasoline (occurring during tank refilling or vehicle fueling). One site in the WHPA, the Dairy Mart at 984 Dubois Road (located within zone 3 on Figure 3-1), appeared on the list, with three registered 10,000-gallon gasoline tanks.

  During the windshield survey , three above-ground heating fuel tanks were observed. Two were located along Franklin-Trenton Road, one within the one-year TOT area, the other within the five-year TOT area; the third tank was observed on property lying along Martz-Paulin Road, in the five-year TOT area. These tanks were estimated to have a capacity of approximately 100 to 200 gallons. Although home heating fuel tanks with less than 2,000-gallon capacity are not regulated, they may potentially leak oil into groundwater and therefore must be included in a hazardous waste inventory.

  A fourth above-ground storage tank was noted on Dubois Road, approximately one-half mile west of the Dairy Mart (in zone 2 on Figure 3-1). The tank, which has an approximate capacity of 2,000 gallons, is located behind a two-story building housing a business that was closed at the time of the survey. The contents of the tank were unknown and could not be determined.

  Warren County will update on an annual basis the list of registered underground storage tanks, violation notices or releases. Also, as staffing and time allow, a more comprehensive site specific file search and field check should be performed for each known UST site by Warren County prior to the next revision upgrade of the WHP plan.

- Unsewered areas are locations that are served by individual septic systems. If not properly operated and maintained, septic systems may release viruses, bacteria, nitrates, household chemicals, and other materials into groundwater. Septic system records are maintained by the Warren County Health Department; however, no master list, index, or location map exists. Therefore, it was not possible to identify septic system locations within the WHPA. CDM reviewed the Warren County sanitary sewer records and conducted a windshield survey of areas in question to establish the areas serviced by sanitary sewers from the areas serviced by septic tanks. The major residential developments in the area under consideration are served by central sewer systems. Developed areas which could not be clearly identified as sewered were classified as having "unknown sewer connections."

- Ms. Christine Straub, of the Ohio Department of Natural Resources (DNR), Division of Water, provided information regarding water well installations within the WHPA. Approximately 275 water wells are known to exist within the five-year TOT boundary. All of these wells appear to be active, and water well logs have been maintained for them. The ODNR receives well-closing information, and Ms. Straub indicated that she was not aware of any closed wells in the area.

  The wells are residential and, as such, are susceptible to contamination from household solvent spills, pesticides, and herbicides. Information about well contamination is collected by the Warren County Health Department. Mr. Larry Wiser of that department indicated that the overall water quality for the well field area was good, and no contamination has been reported in the area wells for several years. He also indicated that wells older than 10 years tended to test positive for the presence of coliforms due to the presence of old well seals or dirty pumps. Also, before centralized sewers replaced septic systems in Franklin and Carlisle, and in subdivisions along Franklin-Trenton Road, nitrate levels were sometimes higher in well water than they currently appear.

  The Division of Water supplied well logs for 54 of the 275 wells. A number of these were for wells located within the one-year TOT boundary. The wells within the one-year TOT area were found to have been drilled through sand, gravel, and clay, with water levels ranging from 20 to 30 feet below ground surface. The 54 water well logs were selected by ODNR to be representative of the wells within the area. The well logs appear in Appendix C.

  The Warren County Combined Health District reports that approximately 95% of the private wells within the 5-year time-of-travel area were installed within the last 20-30 years in accordance with State regulations and construction standards. Most of the wells are fairly shallow (30' deep). The Health Department tests wells in the area on a demand basis and at real estate transfers.

- Mr. Ron Ware of the Ohio EPA, who oversees permitting for Warren County's public and semi-public facilities, noted that he was not aware of any NPDES-permitted facilities within the WHPA. Mr. Ware also discussed NPDES locations with the Ohio EPA's Mr. Mike Zimmerman, who is involved with water pollution control for industrial facilities in Warren County. Mr. Zimmerman indicated that he was not aware of any NPDES locations within the one- or five-year TOT areas.

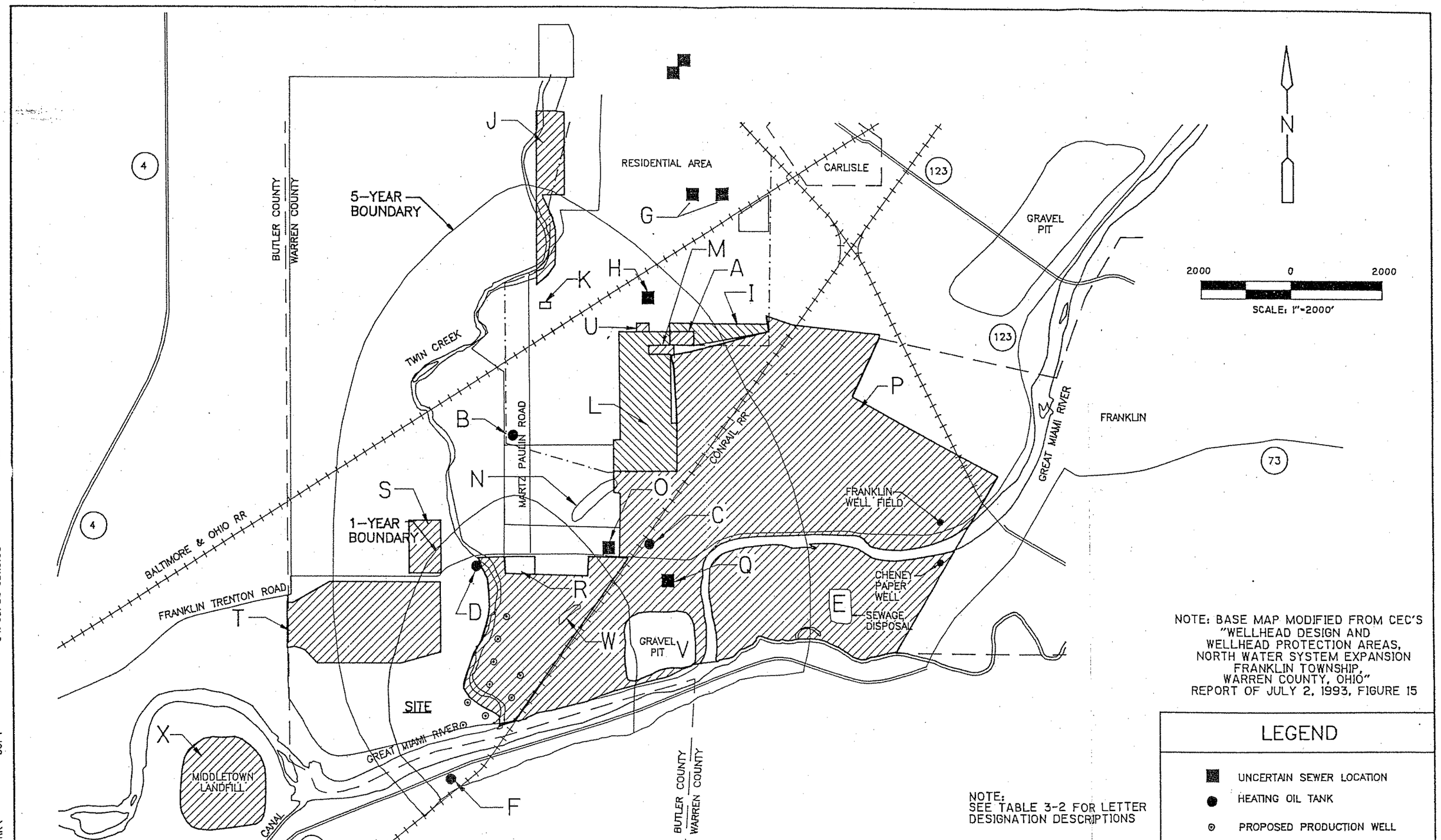
  Mr. Ware indicated that the Franklin Wastewater Plant, located approximately 500 feet east of the five-year TOT boundary, was the closest NPDES-permitted facility to the WHPA. The Franklin WWTP occasionally experiences sludge build-up and releases to the Great Miami River. The sludge solids are biological and act as pathogens. If an accident occurs at the WWTP and the resultant water is induced by pumping into the groundwater, contamination may result in the wells.

- Ms. Diana Zimmerman, of Ohio EPA's Southwest District Water Quality branch, supplied a list of six dischargers to Twin Creek for which Ohio EPA has NPDES records. All dischargers are upgradient but lie outside of the WHPA and Warren County.

To verify the findings of the land-use mapping, database searches, and agency interviews, CDM conducted a windshield survey on July 8, 1993 and again on March 5, 1995. Two surface water bodies were identified within the WHPA, both of which appear on topographic maps of the area. One of these, a small pond located in the one-year TOT area, could not be field-checked because of "No Trespassing" signs and fences surrounding the property. (Note that such signs may themselves be an indication of contamination.) The other water body was also a small pond, this one located in the five-year TOT area and accessible for a field check. The topographic map showed the area to be relatively flat; the pond itself appeared to have been created by excavating gravel at an earlier time. The pond receives drainage primarily from undeveloped areas, although some residential drainage is present. However, the field check indicated that the pond showed no signs of environmental impact, such as dead vegetation, oil sheen, or refuse.

Table 3-2 presents a list of all of the pollution sources identified as a result of the database search, agency interviews, and the windshield surveys, arranged according to location within the zones indicated on Figures 3-1 and 3-2. The table provides information for each pollution source on land use, type of pollution, distance from the well field, risk level (based on ratings from the Ohio EPA's Wellhead Protection Program), and the specific location of each. Note that potential pollution sources exist within the one-year TOT area both because a large portion of this land, though currently vacant, is zoned industrial and because several heating oil tanks and one pond are located within this area.

Figure 3-3 identifies the 24 potential sources by letter and identifies the railroads by name.



NOTE: BASE MAP MODIFIED FROM CEC'S "WELLHEAD DESIGN AND WELLHEAD PROTECTION AREAS, NORTH WATER SYSTEM EXPANSION FRANKLIN TOWNSHIP, WARREN COUNTY, OHIO" REPORT OF JULY 2, 1993, FIGURE 15

NOTE:
SEE TABLE 3-2 FOR LETTER DESIGNATION DESCRIPTIONS

LEGEND

- UNCERTAIN SEWER LOCATION
- HEATING OIL TANK
- PROPOSED PRODUCTION WELL

NORTH WATER SYSTEM EXPANSION, FRANKLIN TOWNSHIP, OHIO

1-YEAR & 5-YEAR
TIME-OF-TRAVEL BOUNDARIES
AND PSI SITE LOCATIONS

3-3

CDM
environmental engineers, scientists, planners, & management consultants

Potential Pollution Source	Approx. Dist. to Wellfield	Zoning[1]	TOT[2]	Map Area[3]	Site Location
High Risk Level					
3 10,000-gal. USTs (gas)	6,800 ft	E Comm/retail	5-yr	3	A - Dairy Mart @ 984 Dubois Road
2 propane tanks and 1 heating oil tank	4,000 ft	E 1-fam. res.	5-yr	6	B - Riverview Baptist Ch. @ Martz-Paulin Rd.
1 heating oil tank	3,200 ft	V Industrial[4]	1-yr	16	C - NE of Franklin-Trenton & railroad intersection
1 heating oil tank	14,000 ft	V Lo-dens. res.[4]	1-yr	21	D - SW of Franklin-Trenton & Twin Creek intersect.
Baltimore & Ohio RR	Varies	Varies	5-yr	---	North of site
Conrail RR	Varies	Varies	1-yr	---	East of site
Medium Risk Level					
Franklin WWTP and Systech	7,000 ft	V Industrial	>5-yr	13	E - East of site; 500 ft east of TOT limit
Kuhn Transport; Swimming Pool Chemicals	2,200 ft	V Industrial	1-yr		F - SSW of site
Low Risk Level					
2 unknown connections[5]	10,000 ft	E 2-fam. res.	5-yr	1	G - E & W of Bobbi. Pl. betw. Nikki & Beth Cts.
1 unknown connection[5]	7,600 ft	E 2-fam. res.	5-yr	1	H - Clyde Ct. & Baker Ln.
Potential private sewer or septic connections	8,000 ft	E Multi-fam. res.	5-yr	4	I - Northeast of site
Pesticides & chemicals	7,500 ft	V Agricultural	5-yr	5	J - NNE of site
No sources observed	7,000 ft	E Comm/retail	5-yr	7	K - Cookie's Market @ Lyn & Martz-Paulin Rd.
Lawn chemicals	4,000 ft	E 1-fam. res.	5-yr	8	L - NE of site
Pesticides & chemicals	7,000 ft	E Agricultural	5-yr	9	M - NE of site
Small pond	2,500 ft	V lo-dens. res.	5-yr	10	N - NE of site
1 unknown connection[5]	2,400 ft	E 1-fam. res.	1-yr	12	O - N of Franklin-Trenton, 600 ft. W of RR
Large industrial area	3,700 ft	V Industrial	5-yr	13	P- ENE of Conrail tracks
1 unknown connection[5]	3,200 ft	E 1-fam. res.	5-yr	14	Q - Hobart Ave. & Miamiview Dr.
Lawn chemicals	1,000 ft	V Lo-dens. res.	1-yr	18	R - North of site
Lawn chemicals	1,700 ft	E 1-fam. res.	1-yr	19	S - NW of site
Lawn chemicals	1,000 ft	E 2-fam. res.	1-yr	20	T- West of site
Undetermined Risk Level					
Above-ground tank (contents unknown)	6,800 ft	E Comm/retail	5-yr	2	U -Unknown business @ Dubois & Chelsea Dr.
American Aggregates gravel pit	2,400 ft	E Industrial	5-yr	15	V- East of site; small portion in 1-yr TOT
Small pond (could not be seen on site visit)	1,000-2,000 ft	V Industrial	1-yr	17	W - Between well field and RR tracks
Additional Area of Concern					
Middletown Landfill	10,000 ft	V Industrial	>5-yr		X - SW of site; 2,600 ft SW of TOT Limit

[1] Zoning: E = Existing land use; V = Vacant land
[2] TOT = Time of travel.
[3] Map areas correspond to areas delineated on Figures 3-1 and 3-2.
[4] Zoning of vacant land may have changed due to existing land use.
[5] Unknown connection = Residence could be connected to sewer or septic tank.

Source: Camp Dresser & McKee, 1993

Table 3-2
Pollution Source Inventory

Section 4
WHPA Management

4.1 Introduction

The purpose of delineating wellhead protection areas (WHPAs) and analyzing land uses in the WHPAs is to identify potential threats to well water quality and to promote actions that will protect the water quality of wells. Two major approaches are available to protect wells from pollution: (1) minimizing risks from existing sources of potential contamination within WHPAs, and (2) using land-use controls to position possible future pollution sources away from wells.

Actions that can be taken to prevent well contamination are known as groundwater protection practices (GWPPs). GWPPs are management practices, and their implementation requires on-going educational programs that focus the attention of public officials, public planners, and engineers, Planning Boards and Zoning Boards, owners/operators of potential pollution sources (including residential homeowners), and water system managers on ways to prevent contamination from reaching water supplies. The possible sources of contamination that might affect a well are too numerous for any single agency to monitor. This section presents a range of wellhead protection actions and GWPPs that are useful in minimizing possible well contamination and can be applied by some or all of the officials and agencies involved in wellhead protection.

4.2 Implementation

The findings of this report will be used to develop strategies for wellhead protection. These strategies will impact Warren County residents in a number of ways. Several options are available for implementing the management strategies:

- Initially, the primary focus of Warren County's Wellhead Protection effort will be on public information. A more detailed description of the Warren County Public Participation Program is found in Section 7. The PSI identifies those commercial and industrial establishments that pose a potential threat to groundwater quality due to the nature of their operation. For public information and notification purposes, a mailing list of residential and nonresidential landowners in the wellhead protection areas will be identified by Warren County.

In this section . . .

- A more long-term and effective approach to wellhead protection can be achieved through direct regulation. Warren County has already enacted a resolution for wellhead protection (Resolution 93-294), which delineates zoning regulations for the aquifer protection and wellhead protection areas in Warren County. A copy of Resolution 93-294 is included in Appendix D. In addition, this wellhead protection report specifically identifies one- and five-year TOT boundaries and recommends limits and management options for potential pollution sources. Upon approval of the wellhead protection plan by Ohio EPA, Warren County will proceed with the establishment of a wellhead protection overlay area as provided by Section 5.80 of the wellhead protection regulations. The regulations control the use, handling and storage of regulated substances within the area, as well as other groundwater protection standards. Although the area is zoned for industrial activity, the aquifer and wellhead protection regulations should adequately control activities and uses within the area.

4.3 Limiting Sources of Contamination

Sources of drinking water pumped from surface aquifers can be affected by pollution that enters the aquifer from individual points of discharge (point sources), or from runoff that carries pollution deposited on the land surface (non-point source). Potential point sources in Warren County's WHPA include:

- Leaks or spills from the above-ground tank (whose contents are unknown) on Dubois Road;
- Leaks or spills from the underground storage tanks at the Dairy Mart on Dubois Road;
- Leaks or spills from any of the heating oil tanks located within the WHPA;
- Discrete chemical spills which might occur at points along the ConRail and Baltimore and Ohio railroad tracks or the Franklin-Trenton or Martz-Paulin roadways;
- Leaching from septic tanks located within the WHPA;
- Lechate from the Middletown Landfill;
- Groundwater recharge from surface water ponds which receive and condense contamination from agricultural chemicals present in runoff from tilled lands; and
- Spills or leaks of industrial chemicals from the American Aggregates gravel pit, the Kuhn Transport, the Franklin WWTP, and/or Systech, which could occur either in the course of normal operations or because of poor product storage and handling practices.

Potential non-point sources include runoff from agricultural and residential lands, which could contain pesticides, herbicides, fertilizer applications, and other chemicals, and from transportation arteries, such as the roadways and

railroad tracks present in the WHPA, which could contain road salts and spills and leaks of fuel and other chemicals.

Although it is technically possible to reduce or eliminate groundwater contamination by means of remedial actions, such actions are very expensive, necessitate developing a replacement water supply during remediation, and can require decades to bring the supply into compliance with drinking water standards. Alternatively, contaminants in water can be removed (or reduced) as part of a water treatment operation, also a costly approach. For these reasons, GWPPs focus on minimizing pollution sources in wellhead protection areas and on having monitoring mechanisms in place to detect contamination before it impacts potable supplies.

Among the general management tools typically included in GWPPs are the following:

- Site plan reviews;
- Building/site design standards;
- Water conservation;
- Zoning ordinance revisions;
- Subdivision ordinance revisions;
- Groundwater monitoring program;
- Household hazardous waste collection;
- Operating standards for potentially hazardous operations;
- Prohibition of development or materials extraction that directly threatens groundwater;
- Spill reporting and emergency response;
- Well field management to control groundwater flow; and
- Public education programs focusing on such areas as:
  - Pesticide/fertilizer application;
  - Road salting;
  - Maintenance of detention facilities;
  - Stormwater management (including runoff controls);
  - Management of septic systems;
  - Inspections/testing of underground storage tanks; and
  - U.S. EPA regulations guiding storage of loading and unloading of hazardous materials.

Note that groundwater protection practices are the same for both the one-year and five-year TOT areas, except for septic tanks and sewer lines. Hook-up to a centralized sewer system are being required for residential developments and commercial establishments located within the one-year TOT area where public sewers are available. Good management practices, as determined by state and local health departments, are required in operating septic systems within the remaining portion of the five-year TOT area.

4.4 Pollution Source Control and Management Options

CDM has adapted material included in Ohio EPA's Wellhead Protection Program to provide information on the use of the GWPP management tools for various public and private sectors. Warren County can select from this list those activities which will be most helpful in administering the wellhead protection program. The material provides information to control groundwater pollution from the following sources: commercial/retail/industrial sites; transportation facilities; agricultural locations; domestic chemical wastes; septic tanks and leach systems; sewer and other transmission lines; and underground storage tanks.

4.4.1 Commercial/Retail/Industrial Sites

Commercial, retail, and industrial sources of groundwater pollution in the County include such locations as automotive dealers and repair shops, the Franklin WWTP, the American Aggregates gravel pit, and miscellaneous manufacturing firms. Activities which can reduce or eliminate groundwater pollution involve materials handling, safety measures, and employee education. Warren County will direct affected businesses to:

- Coordinate with Ohio EPA and other appropriate agencies to ensure that all materials use, handling, storage, reporting, and other safety regulations are enforced.
- Obtain signs or posters, to be posted in work areas, that indicate that the entity is located within a designated wellhead protection area and that explain and promote cautionary measures.
- Promote regular educational programs for facility personnel to supply information and training relative to the WHPA and materials used on the premises, including handling procedures and precautions.

Warren County will review affected businesses compliance with other State and Federal programs which:

- Require proper labeling of all hazardous materials and other deleterious materials present on the premises.

- Require materials safety data sheets that present health and safety data, chemical properties of, and emergency response procedures for all potentially threatening materials to be posted or otherwise readily accessible.
- Require that records be kept by type of potentially threatening materials brought into work areas. These records should include total amounts brought in and total amounts used, and they should be reconciled with records of waste products leaving the work area.
- Require the development of hazardous materials management plans addressing all aspects of the use, storage, and handling of each material at a particular location.
- Require emergency response plans specifying procedures and responsibilities in the event of an accidental spill or other unauthorized release of all potentially threatening materials present on the premises.
- Require regular inspection and maintenance programs for all pipes, drains, traps, vessels and other equipment used to store or transport hazardous or deleterious materials (see Section 4.4.6, Sewer and Other Transmission Lines, below).

In order to monitor the effectiveness of the program Warren County will:

- Perform periodic inspections of the premises including all interior and exterior areas to insure that requirements are being met and that proper practices and precautions are being followed.
- Establish routine ground water monitoring using on-site production wells and properly constructed monitoring wells hydraulically down-gradient from potential contaminant sources (see Section 5, Groundwater Monitoring Plan, below).

4.4.2 Transportation Facilities

Two railroad lines (ConRail and Baltimore & Ohio) traverse the five-year TOT zone (the ConRail tracks also cross the eastern portion of the one-year TOT zone. Three major roads cross the WHPA: Franklin-Trenton Road from west to east, Martz-Paulin Road from south to north, and SR 73, from west to east, across the Great Miami River; all three roads fall within both the one- and five-year TOT zones. In addition, there are a number of smaller roads lying within the five-year TOT zone in the residential area (shown on Figure 3-1 as zones 1, 6, 7, and 8). To alleviate the impacts of these transportation routes on groundwater quality, Warren County will implement the following activities:

- Post all roadways to indicate when entering the WHP zone and provide an emergency number to call in the event of an accident or spill.
- Coordinate with County's Emergency Management Agency in the event of a spill.

- Discuss with State, County, Village and Township officials regarding appropriate de-icing methods and materials that minimize possible ground water impacts.
- For new developments in the unincorporated areas require storm water detention basins and follow a regular basin maintenance program.

Warren County will request appropriate Local and other State agencies to:

- Restrict or prohibit trucks carrying hazardous or other deleterious materials from using Franklin-Trenton and Martz-Paulin Roads.
- Reduce the speed limit for highways and railroads that run through or near the WHPA.
- Monitor existing transportation routes for vehicles transporting hazardous materials and develop recommended alternative routes away from the WHPA.
- Limit the application of road salt and other de-icing agents within the WHPA by utilizing street plowing as much as possible and mixing salt with other materials such as sand, fine gravel or cinders to reduce salt content.
- Maintain records of salt usage within the WHPA.
- Institute a regular program of street cleaning, including late summer when rain may be limited.
- Limit the road widths and provide drainage using, whenever possible, swales or ditches that trap pollutants.
- Require new developments in the unincorporated areas to have water quality basins and follow a regular basin maintenance program.

4.4.3 Agricultural Locations

A small segment of land in the northeast quadrant of the WHPA is currently used for agricultural purposes; another slightly larger segment in the northern extremity of the area is currently vacant is zoned for agricultural purposes. Warren County will implement the following activities to ensure that minimal pollution occurs from these two areas:

- Provide maps to and/or post the boundaries at roadways of the TOT zones for farmers' information.
- Continue ground water monitoring in the WHPA to evaluate potential effects of agricultural activities (see Section 5, below).
- Assist Soil and Water Conservation District personnel in educating farmers on the concepts of wellhead protection and on the latest management practices that maximize crop yield and minimize chemical application.

- Make information available to farmers on the need to provide back-siphoning prevention devices on wells used to mix agri-chemicals or to fill dispensing equipment.
- Make information available to farmers on the need to use impermeable pads with collection dikes for cleaning dispensing equipment.

4.4.4 Residential Chemical Wastes

Residential areas occupy large segments of both the one-year and five-year TOT zones. Public information and education programs are extremely important in these areas to minimize and control the impacts of household and lawn chemicals on groundwater. The Warren County Solid Waste District conducts the following activities:

- Public information/education programs that identify household chemicals and proper use, storage and handling methods.
- Educate consumers on the need to separate household waste from other wastes.
- Conduct special collection programs for hazardous household waste on a periodic basis.
- Develop holding stations where hazardous household wastes can be dropped and then properly disposed of.
- Develop and operate a recycling network to collect used motor oil and similar wastes through commercial and/or municipal garages.

4.4.5 Septic Tanks and Leach Systems

As noted, while the majority of the residences falling within the WHPA are served by a centralized sewer system, however, isolated residential septic tanks of leaching system do exist. Warren County will do the following:

- Identify locations of residences using septic tanks and leach systems.
- Where feasible extend the county's sanitary sewer system to those residences and commercial establishments along Franklin-Trenton Road currently using on-lot disposal systems and require hook-up to centralized sanitary sewer.

The Warren County Combined Health District conducts the following activities:

- Provide home and business owners with information concerning the proper operation and maintenance of septic systems and the possible negative affects on ground water of using septic systems for the disposal of cleaners, degreasers, solvents and other deleterious household and industrial products.
- Prohibit the discharge of hazardous materials or other deleterious materials into any on-site septic systems.

- Require septic tanks to be pumped out and inspected on a routine basis and prior to transfer of property.
- Coordinate with state and local Health Departments to ensure that all siting and installation requirements are met within the five-year TOT zone.
- Set permit-to-install fees at a level sufficient to support a rigorous inspection and enforcement program.
- Recommend that water softeners not be used in combination with septic systems.

4.4.6 Transmission Lines

Several transmission mains exist within the WHP area, including a natural gas main which traverses a portion of the wellfield property. To reduce and control groundwater pollution from these sources, Warren County will do the following:

- Request copies of maps showing precise location of pipelines and require regular inventory reports of substances that pass through the WHPA.
- Request owners of transmision lines to prepare emergency response procedures designed to prevent or minimize groundwater contamination resulting from the release of substances from transmission lines within the WHPA.
- Compile and maintain a list of pipeline operator emergency response telephone numbers.
- Perform routine periodic testing at the monitoring wells to determine if leakage is occurring within the WHPA.

In addition to transmission mains, additional underground pipelines of concern include the sanitary sewer system. Several activities will be undertaken to monitor the sewer lines which are located within the WHPA. These include the following:

- Cooperate with the Ohio EPA and other appropriate agencies to ensure compliance with all existing pretreatment and discharge regulations.
- Maintain maps showing the precise location of all sanitary sewers.
- Perform periodic testing and inspections for exfiltration.

4.4.7 Underground Storage Tanks

Three underground storage tanks are known to exist within the WHPA; these are located on the Dairy Mart property on Dubois Road (in zone 3 on Figure 3-1). Warren County will implement the following procedures to ensure that no contamination occurs from these point sources:

- Coordinate with the Ohio Department of Commerce, Bureau of Underground Storage Tank Regulation (BUSTR), to ensure compliance with all underground storage tank regulations.

- Request proper identification, including size and stored material, for these three underground storage containers.
- Control installation of any new underground storage tanks within the one-year TOT zone in accordance with Resolution 93-294.
- Control USTs, with the exception of vehicle fuel USTs, within the 5-year TOT zone. Installation of new vehicle fuel underground storage tanks within the five-year TOT will meet all rules and regulations of the BUSTR program and will meet all of the requirements for new and existing tanks.

BUSTR regulations:

- Require regular inspection, testing, and maintenance programs for all underground storage tanks and associated piping within the WHPA.
- Require that records of deliveries and consumption be reconciled daily against measured inventory to detect product loss.
- Require monitoring of the areas adjacent to tanks within the WHPA to detect any subsurface leaks. Electronic leak-detection devices may be used for this purpose.
- Require all tanks to be equipped with overfill protection.
- Require secondary containment systems for storage vessels within the WHPA that are capable of holding at least 110% of the contents of the vessel.
- Require development and posting of emergency response procedures in event of a leak or spill.

4.5 Land Use Controls

Most of the vacant land within the WHPA is zoned either residential (the western half of the area) or industrial (the southeastern quadrant). In order to minimize risk to groundwater supplies through appropriate spatial distribution of future development in these areas, Warren County has developed ordinances for land use control in these areas. Developments with high wellhead pollution potential will be specifically guided away from prime aquifer recharge zones.

For example, construction of septic systems within the one-year TOT will be discouraged because of possible contamination by microbial pollutants. In addition, the County will consider changes to zoning of land to exclude significant potential sources of pollution within the one-year or five-year TOT zone of a wellhead protection area.

Other activities for maintaining control of land use to minimize impacts of development on groundwater include the following:

- Require either pre-development ground water monitoring at proposed sites with high-risk pollution potential to establish baseline conditions for water quality data or enactment of pollution prevention methods.
- Receive public comments for all proposed development within the wellhead protection area; concerning the proposed development of a facility, its operation, procedures, and process chemical usage, and plans for ensuring environmental and public safety.
- Review with the Warren County Regional Planning Commission the possibility of changing current industrial zoning within the one-year TOT zoning to a zoning designation less likely to lead to contamination in the area, such as residential or agricultural, and to assure appropriate zoning for the future that will minimize the potential for wellhead pollution.
- Attempt to purchase property or control use of properties surrounding the well field to control any future development.

Coordination is required between state, county, and local governments to optimize protection of groundwater resources. Each unit of government has jurisdiction over different sources of pollution and has available different methods of controlling pollution. In addition, because ground water travels across municipal borders, neighboring townships and cities should be informed of WHPAs and urged to cooperate in their protection.

Section 5
Groundwater Monitoring Plan

The proposed Groundwater Monitoring Plan describes the procedures by which Warren County can monitor the quality of groundwater entering the North Water System well field expansion area from downgradient of potential pollution sources. The plan addresses Phase I of the expansion (well field yield of 3.0 MGD). The plan should be expanded in the future, as necessary, after implementing the WHPA Management Plan, and to accommodate Phase II of the expansion (well field yield of 8.0 MGD) and new pollution sources as they are identified.

The Groundwater Monitoring Plan includes the following elements required by the Ohio EPA:

- Proposed monitor well locations to monitor wellfield;
- Proposed monitor well design features;
- Groundwater sampling and analysis plan;
- Quality assurance and control procedures; and
- Periodic evaluation of the groundwater monitoring program.

5.1 Monitoring Locations

The objective of the groundwater monitoring plan is to provide a monitor well network that will enable early detection of groundwater pollutants that may pose a threat to the well field. To meet this objective CDM proposes to locate monitor wells near high-risk pollution sources and at positions within the aquifer that would transport contaminants to the wellfield the fastest. The installation of monitor wells at seven locations are recommended in this plan as discussed below.

Table 5-1 presents a summary of the proposed monitor well locations, the type of monitoring to be conducted, and the rationale for each. The monitoring locations are shown in Figure 5-1. A more detailed discussion follows.

In this section . . .

Location	Sample Type*	TOT	Rationale
A	Shallow GW strata	9	Potential leaks from heating oil tank
B	Shallow GW strata	6	Potential spills from Conrail Railroad
C	Most permeable GW strata	6	Potential low-and medium-risk area sources of pollution based upon land use conditions
D	Most permeable GW strata	9	
E	Most permeable GW strata	9	
F	Most permeable GW strata	9	
G	Most permeable GW strata	9	
H	Surface water	9	Potential spills into Twin Creek

*GW = groundwater

Table 5-1
Rationale for Sampling Locations

5.1.1 Shallow Monitor Wells

Six potential pollution source areas have been identified in this report as having a high risk level, within the 5 year TOT area; however, only two of these sources are within the 1-year TOT boundary (see Table 3-2). These are:

- Heating oil tank, SW of Franklin-Trenton Road and Twin Creek intersection.
- Conrail Railroad.

In addition, there are several other areas of concern which will be subject to evaluation with each monitoring well plan update. These include:

- Middletown Landfill
- Franklin WWTP
- Systech

The relative proximity of these high-risk sources within the 5-year TOT to the well field indicates the need for frequent groundwater monitoring in the shallow zone of the aquifer near the source. This would enable immediate detection of releases of contaminants from the sources to the aquifer. The frequency of monitoring will be established based upon the estimated TOT from the source to the well field and the minimum response time required to implement the Contingency Plan (see Section 6). The remaining four high-risk potential pollution sources are outside the 1-year TOT boundary and, thus, do not necessitate frequent groundwater monitoring; based upon current information. The initial monitoring wells will be sampled and the updated hydraulic model will be reassessed to identify whether additional monitoring wells should be installed within the 5 year TOT area or beyond, depending upon refinements of the model and TOT delineation.

5.1.2 High-Permeability-Zone Monitor Wells

In addition to the high-risk potential pollution sources, several low- and medium-risk potential pollution sources that are located within or just outside the 1-year TOT boundary have been identified. Although these sources have been assigned a lower risk level with respect to the types of chemicals used or stored on site, their relatively close proximity to the well field is of concern. Since many of these potential sources of pollution are area sources based upon land use conditions rather than specific point sources, CDM recommends that groundwater monitor wells be installed at strategic locations upgradient of the well field and downgradient from the source areas.

The proposed locations of the monitor wells are based upon the capture zone analysis performed by CEC for a maximum Phase I well field yield of 3 MGD. The frequency of monitoring will be established based upon the estimated TOT from the proposed monitor well location to the well field and the minimum response time required to implement the Contingency Plan (see Section 6). This groundwater monitor well network should focus on the most permeable strata within the vertical section of the aquifer, which will be responsible for transporting contaminants to the well field the quickest.

CDM recommends the installation of six additional monitor wells at locations labeled A through G as shown in Figure 5-1. Shallow monitor wells should be installed at locations A and B close to the heating oil tank at the intersection of Franklin-Trenton Road and Twin Creek and Conrail Railroad line, respectively. Monitor wells should be installed at locations C, D, E, F, and G to establish the quality of groundwater entering the well field area in the most permeable zone of the aquifer. Monitoring wells G and C are located between the Middletown Landfill, Systech and the well drilling/production area. The placement of these wells allows a hydraulic gradient to be extablished based on the actual production rate of the wellfield. The model will be updated and calibrated based on the monitoring well results depicting actual groundwater system. Existing monitor well OW-2 should be evaluated after completion of field tests (see Monitor Well Construction Methods below) and a visual inspection of the area to determine if it can be utilized either in place of installing the shallow monitor wells at location B or the high-permeability-zone monitor well at location C.

5.1.3 Surface Water Monitoring

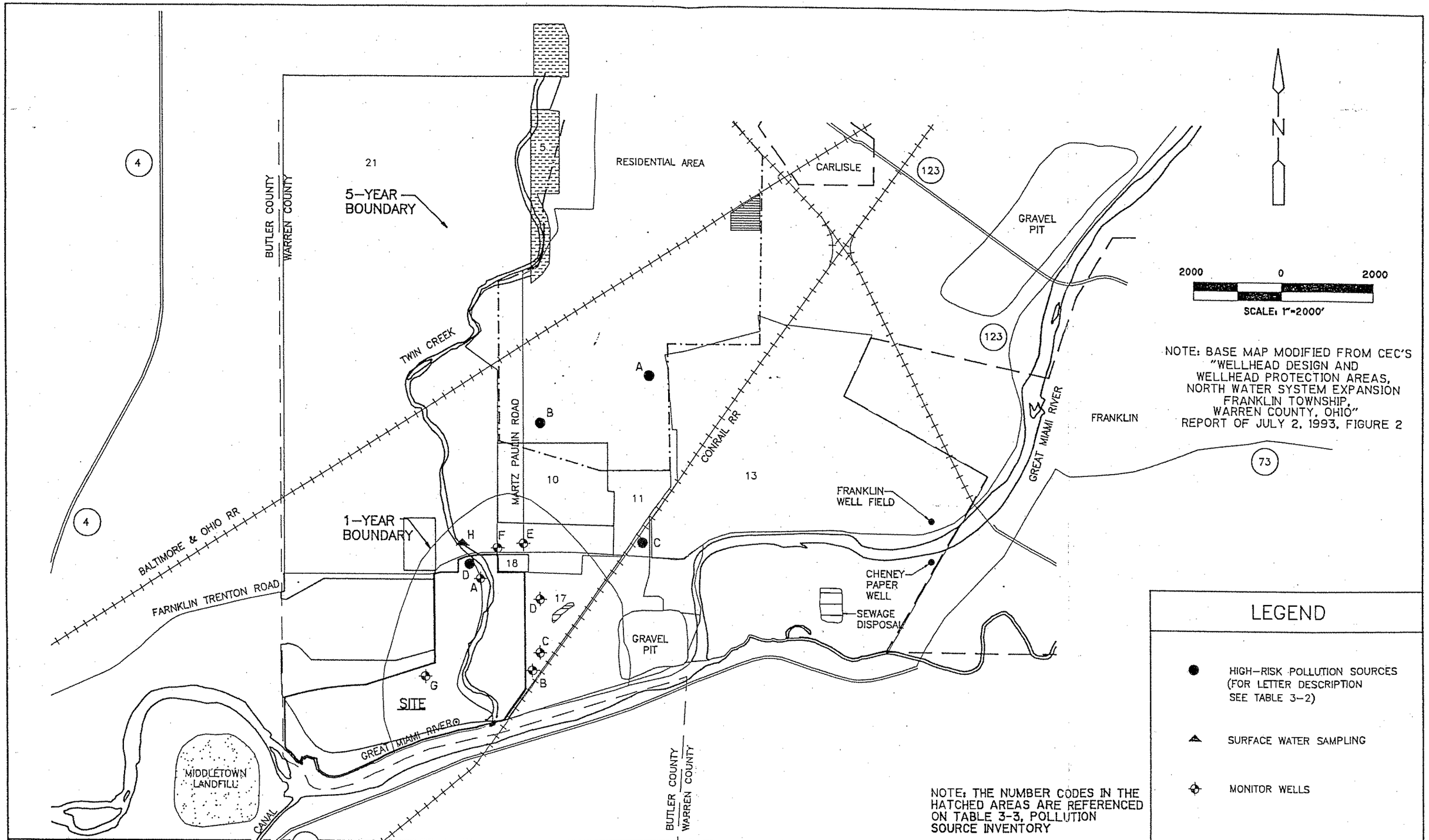
The shallow aquifer is hydraulically connected to Twin Creek. Therefore, the water quality of this surface water body should be monitored upstream of the Phase I well field capture zone. A convenient sampling location is at the Dayton-Oxford Road bridge crossing Twin Creek. This location is labeled H in Figure 5-1.

5.2 Monitor Well Construction Methods

Prior to installation, well construction details and specifications should be prepared. Monitoring wells should be installed by a qualified drilling contractor under the observation of an experienced hydrogeologist.

The water table in the vicinity of the proposed shallow monitor well locations (A and B) is approximately 10 feet below surface level. Therefore, the shallow monitor wells should be drilled to a total depth of about 20 feet, depending upon conditions encountered in the field. The well screen in the shallow monitor wells should be 10 feet in length and positioned to straddle the water table to allow floating contaminants such as oil or gasoline to be detected.

The saturated thickness of the sand and gravel aquifer ranges from 40 feet to as much as 90 feet in certain areas of the well field site. Boring logs available from previous hydrogeologic investigations provide insufficient information to determine the most transmissive zone within the aquifer at the proposed



NORTH WATER SYSTEM EXPANSION, FRANKLIN TOWNSHIP, OHIO

PROPOSED MONITORING LOCATIONS

FIGURE 5-1

CDM
environmental engineers, scientists, planners, & management consultants

groundwater monitoring locations. Therefore, field tests should be performed to determine the most permeable strata within the aquifer at proposed monitor well locations C, D, E, and F.

Two different field test methods are commonly performed for this purpose. The first method involves using a screened auger and performing a rising-head permeability test. A 10-foot interval is drilled and then a slug test is performed for the interval. This is repeated for the entire length of the aquifer. The monitor well is then completed with the permanent screen positioned at the most permeable interval. The time required to install a monitor well using this method is usually twice the time required to install a standard monitor well. Installation of the four proposed monitor wells using this method would require at least four work days.

The second method involves using a piezocone, a 1-inch diameter drill rod equipped with load and pressure sensors (transducers) which communicate various soil characteristics as well as hydraulic conductivity to a computer. The test proceeds by thrusting the piezocone directly into the ground. Data from the transducers are measured and transmitted to the surface for real-time computer displays and disc storage. The advantage of using this method is that subsurface conditions can be measured at several locations in a relatively short period of time (less than one work day). The disadvantage of using this method is that the resulting boreholes would be inadequate for permanent monitor wells. Therefore, larger diameter boreholes would have to be drilled for installation of permanent monitor wells. The data collected from the piezocone test would, however, enable the monitor well borehole to be drilled to the desired depth. The total time required to install the four proposed monitor wells using this method is estimated to be two to three work days. Due to the efficiency and associated cost savings which can be achieved using this method, CDM recommends that it be employed during the installation of monitor wells at locations C, D, E, F, and G.

5.3 Sampling and Analysis Plan

The proposed sampling and analysis plan is based upon the estimated TOT from the monitor wells to the well field, the types of pollutants associated with potential pollution sources identified in this report, and the minimum response time required to implement the Contingency Plan. Table 5-2 presents the rationale for the sampling frequency for groundwater quality at each of the proposed monitor well locations. The minimum response time assumes a worst-case situation where pollutants are released to the groundwater the day after a sample is collected at the monitor well. The time required for laboratory analysis and data evaluation to be performed is not, however, taken into account. These tasks would reduce the response time by one to three weeks depending upon the laboratory turnaround time.

Location	Sample Type*	TOT (months)	Min. Response (months)	Sampling Frequency (months)
A	Shallow GW strata	9	3	3
B	Shallow GW strata	6	3	3
C	Most permeable GW strata	6	3	3
D	Most permeable GW strata	9	3	3
E	Most permeable GW strata	9	3	3
F	Most permeable GW strata	9	3	3
G	Most permeable GW strata	9	3	3
H	Surface water	9	3	3

*GW = groundwater

Table 5-2
Rationale for
Sampling Frequency

In addition to collecting samples for water quality analyses at the specified frequency, water levels should be measured at each of the wells on a quarterly basis. Other general water quality tests that can easily be performed in the field (such as pH and conductivity) should also be conducted on a quarterly basis.

The initial monitoring program is expected to cost approximately $16,000 per year for laboratory services only, exclusive of cost of collecting and transporting samples and record keeping. This is in addition to the cost of installing the monitoring wells, extimated to be $40,000.

5.3.1 Groundwater Sampling Procedures

Groundwater quality samples should be collected from each monitor wells according to the schedule specified above. Specific information pertaining to the sample handling and analyses procedures are included in this section.

Well purging will be conducted using a dedicated "Well Wizard" bladder pump. Readings of discharge water pH, conductivity and temperature will be made a minimum of three times during purging. A groundwater sample will be collected when the well water is free of visible sediment and when pH, conductivity and temperature have been shown to be stable (within 10%) for a minimum of three successive readings and at least 3 casing volumes have been purged from the well. If stabilization of these parameters is not achieved, a maximum of five casing volumes will be removed from the well. If the well is pumped dry, this constitutes an adequate purge and the well can be sampled following adequate recovery. Since analyses will be performed for metals and volatile organic compounds, a teflon bailer will be used to collect the sample. **Table 5-3** on the next page, presents the sample volume required, container type, preservation method to be used, and maximum holding time for groundwater parameters.

To determine the casing volume, measure the distance from the bottom of the well to the static water level, then measure the inside diameter of the well or casing. Obtain the volume of the well by the formula:

$$V = 0.041\ d^2h$$

Where h = depth of water in feet

d = diameter of well in inches

V = volume of water in gallons

Temperature, specific conductance, and pH shall be measured each time a well is sampled. Stabilization of these parameters is measured during the purging process to evaluate the adequacy of the purging procedure. In this situation, the final measurements for these parameters prior to samplinshall be considered the measurement of record for the well. If these parameters were not evaluated during purging, they shall be obtained prior to sampling.

Analysis	Volume/Container**	Preservative	Holding Time	Method***
Alkalinity	100 ml P,G	Cool 4°C	14 days	310.1
Chloride	50 ml P,G	None	28 days	325.3
Coliform, total	100 ml P,G	Cool 4°C, 0.008% $Na_2S_2O_3$	6hours	114/108
Cyanide	500 ml P,G	NaOH, Cool 4°C	14 days	335.1
Fluoride	300 ml P	None	28 days	340.2
Mercury	200 ml P,G	HNO3	28 days	245.1
Metals (except Hg)*	200 ml P,G	HNO3	6 months	200.7
Nitrate	100 ml P,G	Cool 4°C	48 hours	353.2
Nitrate-Nitrite	100 ml P,G	H_2SO_4, Cool 4°C	28 days	353.2
Nitrite	100 ml P,G	Cool 4°C	48 hours	353.2
Radioactivity, gross alpha	100 ml P,G	HNO_3 to pH<2	6 months	900
Radioactivity, gross beta	100 ml P,G	HNO_3 to pH<2	6 months	900.0
Sulfate	50 ml P	Cool 4°C	28 days	375.4
Total Dissolved Solids	100 ml P	Cool 4°C	7 days	160.1
Volatile Organic Compounds	3-40ml G, Teflon-lined Septum	Cool 4°C, HCl to pH<2	14 days	524.2

Notes:

*Metals include antimony, arsenic, barium, beryllium, cadmium, calcium,chromium, iron, lead, magnesium, manganese, nickel, selenium, silver, sodium, and thallium.

**P=polyethylene, G=glass

***EPA Methods.

Table 5-3
Sample Preservation, Container, and Holding Time Requirements

The samples will be transferred from the dedicated pump to the sample bottles, beginning with the VOC samples. Samples will not be field-filtered.

Equipment will be calibrated according to the manufacturer's recommendations.

All equipment used in sample collection that may potentially contact the sample media shall be decontaminated prior to the collection of each sample. The procedure to decontaminate items such as teflon bailers will be as follows:

1. Clean item with hot potable water and phosphate-free, laboratory-grade detergent (Liquinox or equivalent), using a brush if necessary to remove particulate matter and surface films.

2. Rinse thoroughly with hot potable water.

3. Rinse thoroughly with at least a 10-percent nitric acid solution.

4. Rinse thoroughly with potable water.

5. Rinse thoroughly with analyte-free water.

6. Rinse thoroughly with solvent and allow to air-dry for at least 24 hours.

7. Wrap with aluminum foil, if necessary, to prevent contamination of equipment during storage and transport.

8. Rinse thoroughly with potable water in the field as soon as possible after use.

5.3.2 Sample Handling

Chain-of-Custody Procedures

It is imperative that an accurate record of sample collection, transport, analysis, and disposal be maintained and documented. Therefore, chain-of-custody procedures will be instituted and followed throughout the sampling program.

Chain-of-custody procedures include field custody, laboratory custody, and the development of evidence files. The National Enforcement Investigation Center (NEIC) of the EPA states that, to establish custody of evidence, by definition, samples must be:

- In actual physical possession

- In view after being in physical possession

- In a locked repository
- In a secure, restricted area

It is necessary to establish documentation to trace sample possession from the time of collection until disposal. Field custody requirements include the following.

- As few people as possible shall handle the sample(s).
- The sample collection personnel shall be responsible for the care and custody of the samples until they are transferred or dispatched properly.

Samples shall be stored only by those individuals or facilities designated on the Chain-of-Custody Form. The following procedures will be used to ensure proper transfer documentation.

- Samples shall be accompanied by a chain-of-custody record at all times.
- Samples shall be packed properly for shipment so that bottles will not dislodge and/or break during shipment.
- Shipped samples shall contain separate custody records (one for field laboratory, one for samples hand delivered to an off site laboratory, and one for samples shipped off site).
- Samples shall be shipped via a 24-hour delivery service, when required, to ensure holding times are not exceeded.
- Method of shipment, courier name(s), and other pertinent information shall be recorded on the Chain-of-Custody Form including those special handling procedures as available by the delivery service during shipment of the samples.
- If either party refuses a split sample, the refusal shall be noted and signed by both parties.
- All records pertaining to the shipment of a sample shall be retained (freight bills, post office receipts, and bills of lading).

The laboratory shall not accept samples for analysis without a correctly prepared Chain-of-Custody Form. The laboratory shall be responsible for maintaining chain-of-custody of the sample(s) from time of receipt to disposal.

The Chain-of-Custody Form shall be signed by each individual who possesses the samples. Preparation of the Chain-of-Custody Form shall be as follows.

- For every sample, the chain-of-custody record shall be initiated in the field by the person collecting the sample. Every sample shall be assigned a unique identification number, as described in Section 3.1, that is entered on the Chain-of-Custody Form. Samples can be grouped for shipment using a single form.

- The record shall be completed in the field to indicate project, sampling team, and other pertinent information.

- If the person collecting the sample does not transport the samples to the laboratory or deliver the sample containers for shipment, the first block for "Relinquished By _____," "Received By _____" shall be completed in the field.

- The person transporting the samples to the laboratory or delivering them for shipment shall sign the record form as "Relinquished By _____."

- If the samples are shipped to the laboratory by commercial carrier, the Chain-of-Custody Form shall be sealed in a watertight container, placed in the shipping container, and the shipping container sealed prior to being given to the carrier.

- If the samples are directly transported to the laboratory, the Chain-of-Custody Form shall be kept in the possession of the person delivering the samples.

Once the Chain-of-Custody Form has been completed according to these guidelines and signed by each individual who possesses the samples, it shall be returned to the laboratory representative.

Sample Packaging

The transportation of environmental samples from the time they are collected to their arrival at the laboratory is an integral part of the quality control process. The mode of travel must be such that the sample is not altered physically, chemically, or biologically. The travel time to the laboratory must not exceed the maximum sample holding time. Proper chain-of-custody procedures must be maintained during the transportation process.

Samples collected at the site will be immediately placed in the sample cooler. Once the cooler is filled with samples, it shall be locked and securely positioned

in a sampling vehicle or other secure storage facility until the completion of the day's sampling activities. The following protocol will be used for packaging samples.

- Only waterproof metal or equivalent-strength plastic ice chests and coolers will be used.
- Approximately 3 inches of inert cushioning material will be placed in the bottom of the cooler.
- The sample containers will be placed upright in the cooler in such a way that they do not touch and will not touch during shipment. In addition, all sample containers will be placed in clear plastic leak-proof bags. Care will be taken to ensure that sample labels are legible through the bag.
- Additional inert packing material will be placed in the cooler to partially cover the sample containers. Ice or freeze packs will be placed around, among, and on top of the sample containers.
- Each cooler will be filled with additional cushioning materials to prevent movement of samples during shipment.
- The Chain-of-Custody Form will be placed in a waterproof plastic bag just under the lid of the cooler.
- If the cooler is equipped with a drain plug, it will be taped shut.
- The cooler lid will be secured with strapping tape at a minimum of two locations. No labels will be covered.
- Sample bottles and shipping coolers will be secured with custody seals.
- Sample shipments will conform with all Department of Transportation (DOT) guidelines.

5.3.3 Sample Analysis

Table 5-3 presents the recommended analyses for samples collected at monitor locations A through G at the specified frequency. Recommended analysis is based upon the analysis for new wells required by Ohio EPA.

5.3.4 Quality Assurance Procedures

The field quality assurance procedures described in this section are designed to ensure that the samples collected during the field operations provide both accurate and representative data. The samples to be collected as a part of the

field quality assurance program are described below. Organic-free water will be used to prepare blanks. The number of blanks and spiked samples is predetermined and labeling as such takes place in the field.

Replicate Samples

Replicate samples are collected as a measure of the precision of the sample collection process. Replicates are collected at the same time using the same procedures, the same equipment, and the same type of containers as the required samples. They are also preserved in the same manner and submitted for the same analyses as the required samples. Ten percent of all samples are collected in duplicate.

Organic Trip Blank

Organic trip blanks are used to monitor the effectiveness of sample handling techniques during investigations in which samples for organic compound analyses are collected. Two sealed preserved (or unpreserved, if appropriate) volatile organic analysis vials and one sealed container each for other organic compounds are filled with organic-free water and transported to the field. These samples are handled and treated in the same manner as the other samples collected for organic compounds. These samples are identified on sample tags and chain-of-custody records as trip blanks.

Field Blanks

Field blanks are used to evaluate the effects of on-site environmental contaminants (including the presence of atmospheric contaminants), the purity of reagents used as preservatives or additives, and the general sample containers filling/collection techniques.

Field blanks are prepared by filling the sample container(s) with analyte-free water, adding appropriate preservatives or additives, sealing the containers, and completing the appropriate documentation. The bottles are filled out-of-doors next to a well that has been or will be sampled. The field blanks must be handled in the same manner as the sample group for which it was intended (i.e., blanks must be stored and transported with the sample group). Note: the water for VOA field blanks should be from the same source as the trip blank water.

One field blank per parameter group per day will be prepared, or a quantity equal to 5% of the samples in the parameter group per day, whichever is greater. Based on demonstrated quality control procedures, Warren County may request a reduction in the frequency of analyzing field blanks.

Equipment Blanks

Equipment blanks are required if sampling equipment must be cleaned in the field and reused for subsequent sample collection. Equipment blanks are also required for equipment cleaned in the laboratory and transported to the field for sampling activities. These blanks are used to determine the effectiveness of field cleaning procedures as well as those sources of contamination that may be found in the trip blank.

The final rinse water (analyte-free) shall be rinsed on or through the sampling equipment, collected in appropriate sample containers and preserved. These blanks must be included in the same storage and transport containers as the samples.

At least one composite equipment blank must be submitted for each decontamination procedure used in the sampling process. If a piece of equipment is cleaned more than 20 times in one sampling event, equipment blanks must be submitted at a rate of 5% for each equipment type. For each equipment blank collected, aliquots must be taken and properly preserved for each method group. Note: the water used for volatile organic equipment blanks should be from the same source as the trip blank water.

5.3.5 Data Evaluation

Upon completion of laboratory analysis and receipt of the laboratory report, the data should be tabulated to evaluate whether groundwater quality has been adversely impacted. The results should be evaluated with respect to historical groundwater quality data to determine whether any significant changes in concentrations of constituents have occurred. The data should also be evaluated with respect to the tolerance limits of the water treatment plant. If significant changes have occurred or the concentrations of constituents exceed the tolerance limits, then appropriate measures described in the Contingency Plan should be implemented.

CDM recommends that the analytical parameter list be evaluated after two years of monitoring to determine whether some analytes can be removed from the list or whether other chemicals need to be added to the list.

5.4 Modifications to the Groundwater Monitoring Plan

As indicated above, the actual monitor well locations are subject to field tests and visual observations that will be conducted during installation of the monitor wells. The actual number and location of the monitor wells is also dependent upon the final location and pumping rate of the Phase I production wells.

Additional modifications to the groundwater monitoring plan may be necessary as a result of implementing the Phase II well expansion plan, identification of additional potential pollution sources, or discovery that the response time is inadequate to implement the contingency plan. Notwithstanding modifications made to address these specific situations, the groundwater monitoring plan should undergo a comprehensive re-evaluation every two years, or more if necessary, to determine whether the program should be expanded or changed.

Section 6
Contingency Emergency Response Plan

6.1 Introduction

Warren County has a Water Supply Contingency Plan currently in place, prepared by the operating staff of the Warren County Department of Water and Sewers, with assistance from Operating Consultant Services, Inc. The plan was last revised in 1989. Chapter 3745-85 of the Ohio Administrative Code (OAC) requires the water systems in Ohio to have such plans for providing safe drinking water during emergency conditions.

With the advent of Ohio's Wellhead Protection Program, water system purveyors are asked to update their contingency plans to address corrective measures in the event of potential well field contamination, identify temporary and long-term alternate drinking water supplies, and indicate financial mechanisms for implementing such alternatives.

In this section, CDM delineates necessary changes to the contingency plan required to incorporate the new well field into the plan and identifies sources of possible contamination that should be addressed. CDM also describes options for implementation and financing of temporary and long-term alternate drinking water supplies already identified in Warren County's existing contingency plan. This section also addresses provisions for revising the contingency/emergency plan to comply with SARA Title III and Ohio Revised Code (ORC) Chapter 3750.

6.2 Contingency Plan Update

The current Warren County Water Supply Contingency Plan describes emergency situations and potential impacts on the county's water supply systems. The plan also describes the parties responsible for implementing corrective actions during emergencies and potential responses to situations. The new well field will introduce additional possible emergency situations which need to be addressed.

CDM is in the final design phase of the new well field, but plans have not been completed. Once completed, the system description needs to be incorporated into the contingency plan. Emergency response actions are anticipated to be similar to those in the Emergency

In this section . . .

Response section of the current Warren County Water Supply Contingency Plan. However, procedures to address groundwater contamination that may result from a release of hazardous substances to the environment are not addressed in the current plan. Potential sources of such releases were noted earlier in this report, in the pollution source inventory (Table 3-2), and methods of managing pollution have been noted in Section 4 of this report. These controls should be included in the County's contingency/emergency response plan

Updates to the existing contingency plan should include:

- Final design and operation of the new well field;
- Resolution Number 93-294, adopted date March 23, 1993 which amends the Warren County Rural Zoning Code to add aquifer protection and wellhead protection (Chapter 3); and
- A discussion of alternate water supplies available for the existing well field and the North Water System Expansion that are currently in place.

  Lebanon-Franklin Connections to back up water supplies:

  - #1 - City of Middletown - Connected approximately 100 ft west of Dixie Highway (Old 25) on the North side of Manchester Road.
  - #2 - Booster station at South Dixie Water Tower. One pump rated at 250 GPM @ 170 TDH. Operates manually.
  - #3 - Routt Lane Booster - Located on 123 North of Routt Lane. Two 125 GPM Pumps @ 300 TDH and one 250 GPM pump @ 320 TDH. Pumps operate automatically based on level in Red Lion water tower. A 150,000 gallon detention tank is filled by connection to the City of Franklin.
  - #4 - City of Springboro - West of Bunnell Hill Road on Lytle-Five Points Road.
  - #5 - City of Lebanon - On State Route 48 South of Hoffman Avenue.
- Additional vulnerability analyses addressing potential pollution sources including:
  - Uncertain sewer connections/potential septic systems;
  - above-ground storage tanks (heating oil, propane);
  - Dairy Mart's underground storage tanks;
  - Surface water ponds;
  - American Aggregates gravel pit operations;

- Franklin Wastewater Treatment plant operations;
- Conrail and Baltimore Ohio Railroad Tracks;
- Industrial, commercial, public, agricultural, residential and open space zoning (as noted in Appendix D)

6.3 Implementing/Financing Alternate Water Supplies

Alternate water supplies are adequately addressed in the existing Warren County Water Supply Contingency Plan. Existing backup water supplies will also cover the new well field and, therefore, no financing will be required.

6.4 Contingency/Emergency Planning

Discussions with Mr. John Gambill of Warren County Emergency Management Agency, and Ms. Pat Heughebart of the Ohio Emergency Management Agency (Ohio EMA), both of whom make up the local emergency planning committee (LEPC) for Warren County, indicated that the emergency plan required by the SARA Title III (which was to be completed by October, 1988) has not yet been completed. This document will incorporate SARA Title III and Ohio Revised Code (ORC) 3750.

Ms. Heughebart indicated that, while this plan is being rewritten, standard hazardous materials response procedures are being employed by hazardous materials teams (HazMat) (fire, police, etc.) in Warren County. The LEPC expressed interest in working with Warren County for communication of emergency planning between agencies involved with emergency management and wellhead protection.

CDM recommends that Warren County work with the LEPC to document emergency planning procedures, including those procedures currently employed by HazMat teams. Emergency responses should specifically address vulnerability analyses, as discussed in Section 6.2, above.

Section 7
Public Education Program

The objective of the Warren County Wellhead Protection (WHP) Public Education Program is to provide information to the general public about the WHP plan, groundwater protection issues and water conservation. An important step in establishing a public education program is selecting the target audience. The goal in selecting the target audience is to reach a high percentage of the total population who live within or impact the WHP area. The target audience groups selected for the Warren County Wellhead Protection Plan North Water System Expansion are as follows:

- Residential and industrial water users inside the WHP area.
- Commercial and industrial facilities within the WHP area identified as potential sources of groundwater contamination.
- Future customers identified as elementary and high school children of the WHP area.

The following list of options will be used to reach the target audience:

- Utility Bill Inserts.
- Public Meetings.
- Press Coverage.
- Youth Education Programs.

Utility Bill Inserts- Bill inserts can be used as a valuable tool for reaching a high percentage of the affected citizens in the WHP area. A custom made insert should have a simple nontechnical format with the intent of introducing the WHP plan and its impact on local residents. This could be handled in a question and answer format similar to the format developed and used by the Middletown Wellfield Protection Public Education Program. In addition, the insert could include a notification of public meeting's which have been scheduled to address additional questions and concerns regarding the wellfield. A second option is to purchase existing bill inserts. Several inserts are currently on the market which address water conservation and water pollution on a broad scale. The American Water Works Association will provide a sample packet upon request.

Public Meetings - Notice of public meetings should be published in the local newspaper. Additional notification should be sent to commercial and industrial facilities within the WHP area identified as potential sources of groundwater contamination, local public agencies and political jurisdictions. A minimum of two public meetings should be held, the first one to introduce the WHP. This initial meeting can also be used to collect the questions and concerns which can be further addressed in a utility bill insert and at the second public meeting.

Presentations should include a brief overview of the function of a groundwater system and the relationship to the Warren County wellhead protection area. This would be best approached in a graphical media by using either slides or overheads. The time of travel delineation map should be included in the presentation to show the boundaries of the WHP area. Figure 2-4 from this report would adequately cover this. The county may want to address zoning requirements within the WHP area and the importance of protecting the aquifer. A comparison of remediation versus protection of the aquifer should be addressed as well as the benefits to the general public. A section of the meeting should be devoted to outlining the opportunities for community involvement. Topics such as pesticide/fertilizer application, proper management of septic systems and inspection/testing of USTs and water conservation could be addressed. It is important to stress the idea of shared responsibility for all citizens in protecting the drinking water supply. In closing, the people at the meeting should be provided with a contact and phone number which they can use to obtain answer's to further questions.

Press Coverage - Contacting the local newspaper and encouraging coverage that coincides with or precedes bill inserts will increase public awareness and encourage public participation. An article which provides information about the WHP plan and asks for readers response and questions would be helpful in gearing public meetings for content and coverage. A specific invitation should be sent to the established contact at the local newspaper to attend the public meetings.

Youth Education Programs - The development of the youth education programs should be targeted to specific age groups. The local elementary and high schools will be provided with samples of current educational material for water conservation and preservation as well as a contact list. The list of source mateals is expected to include contacts with organizations including, but not limited to: American Water Works Association, U.S. EPA, Ohio Water Education Program and National Project WET. This information should be provided to the local schools in sufficient time to allow the material to be reviewed and where applicable, worked into the existing curriculum.

Section 8
Recommendations for WHPP

In order to institute an effective wellhead protection program, Warren County will undertake those actions necessary to address the potential point and non-point sources of contamination identified in Section 4.3 of this report. Briefly, these potential sources include:

- Leaks or spills from the above-ground tank on Dubois Road;
- Leaks or spills from USTs at the Dairy Mart on Dubois Road;
- Leaks or spills from heating oil tanks;
- Potential spills along railroad tracks or roadways;
- Leaching from septic tanks;
- Lechate from the Middletown Landfill;
- Groundwater recharge from surface water ponds; and
- Chemical spills or leaks from the American Aggregates gravel pit, the Kuhn Transport, the Franklin WWTP, and/or Systech.

Also, for undeveloped land in the WHPA, the revisions to zoning and performance standards, health department roles, and inspections described in Section 4.4 will be implemented by Warren County.

A number of activities can be implemented by the County to accomplish these objectives. These include the following:

- Install fencing to limit access to the County controlled wellfield. Warren County will request private landowners to install fencing around quarries, and borrow pits surrounding the well field, to deter vandalism and unauthorized dumping.
- Coordinate with the Ohio EPA to restrict upstream discharges to Twin Creek, the Great Miami River, and their tributaries that could affect the quality of water recharging the aquifer.
- Perform routine water quality sampling of Twin Creek immediately upstream of the well field.
- Maintain and enforce regulations prohibiting dumping or depositing materials in unauthorized locations.

- Coordinate with the ODNR and local health departments to insure that all abandoned wells are located and properly plugged.
- Plan and install a network of monitoring wells to ensure early detection and response to contaminants moving toward the well field.

Additionally, the following activities will also be underaken:

- Warren County will update the Pollution Source inventory by working with appropriate agencies to identify and locate septic systems and heating oil tanks.
- Warren County will coordinate efforts with Mr. John Gambill and Ms. Pat Hueghebart of the Ohio Emergency Management Agency to develop the hazardous materials emergency response sections of the Water Supply Contingency Plan, as noted in Section 6-2, based on final well field design and potential pollution sources identified in this report;
- The Water Supply Contingency Plan will be revised to include a discussion of the existing back-up water connections.
- Warren County will implement the final Wellhead Protection Plan, pending review and approval of this draft by the Ohio EPA and the appropriate agencies involved; implementation will include the public information program, along with the recommended meetings and presentations.