

ORDINANCE NO. 99-191

AUTHORIZING THE CITY MANAGER TO ENTER INTO A CONTRACT WITH MALCOLM PIRNIE, INC. FOR THE ENGINEERING SERVICES NECESSARY TO DEVELOP A WELL FIELD MANAGEMENT PLAN AND PERFORM AN AQUIFER SAFE YIELD EVALUATION


BE IT ORDAINED by the Council of the City of Mason, Ohio, **six (6)** members elected thereto concurring:

Section 1. That the City Manager is hereby authorized and directed to enter into a contract with Malcolm Pirnie, Inc. for the engineering services necessary to develop a Well Field Management Plan and perform an Aquifer Safe Yield Evaluation, according to the terms and conditions of the proposal attached hereto as Exhibit "A" and incorporated herein by reference.

Section 2. That the Finance Director is hereby authorized to pay Malcolm Pirnie, Inc. an amount not to exceed \$46,000.00 for said work.

Section 3. That this Ordinance shall take effect and be in force from and after the earliest period allowed by law.

Passed this 22nd day of November, 1999.



Mayor

Attest:



Clerk of Council

11/18/99

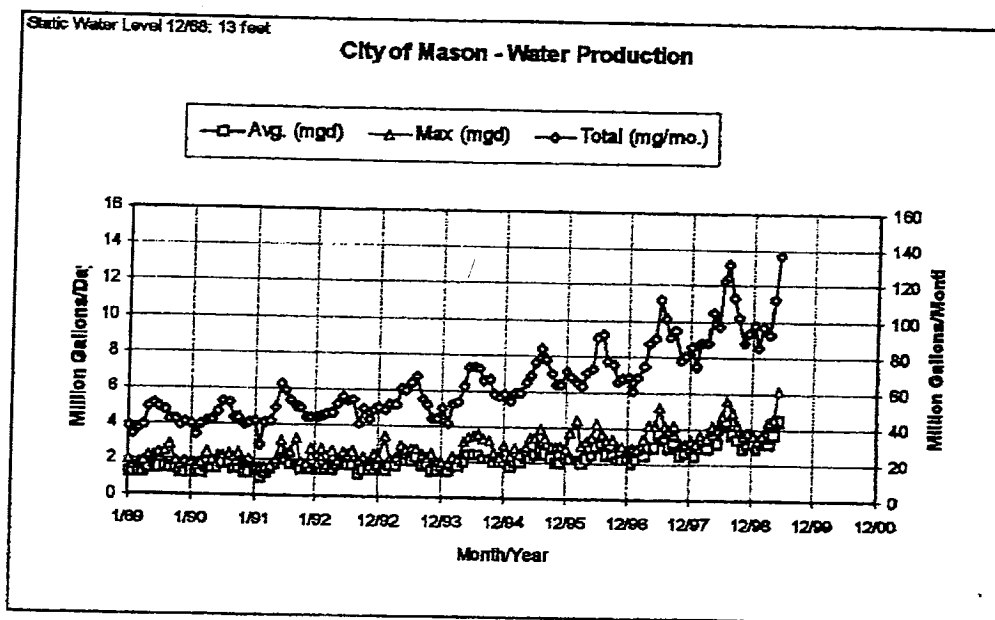
City of Mason Public Utilities Department

Proposal for Well Field Management Program

BACKGROUND

Existing Well Field

The City of Mason owns and operates six groundwater supply wells in the well field adjacent to the water treatment plant. These wells produce as much as 6 million gallons per day during periods of peak demand (see graph). The wells draw ground water from the Shaker Creek Aquifer system at approximately 90 to 130 feet below ground surface. Each well consists of several components including the well screen and casing, pump and pump motor, meters and gauges, piping, and electrical supply and controls.



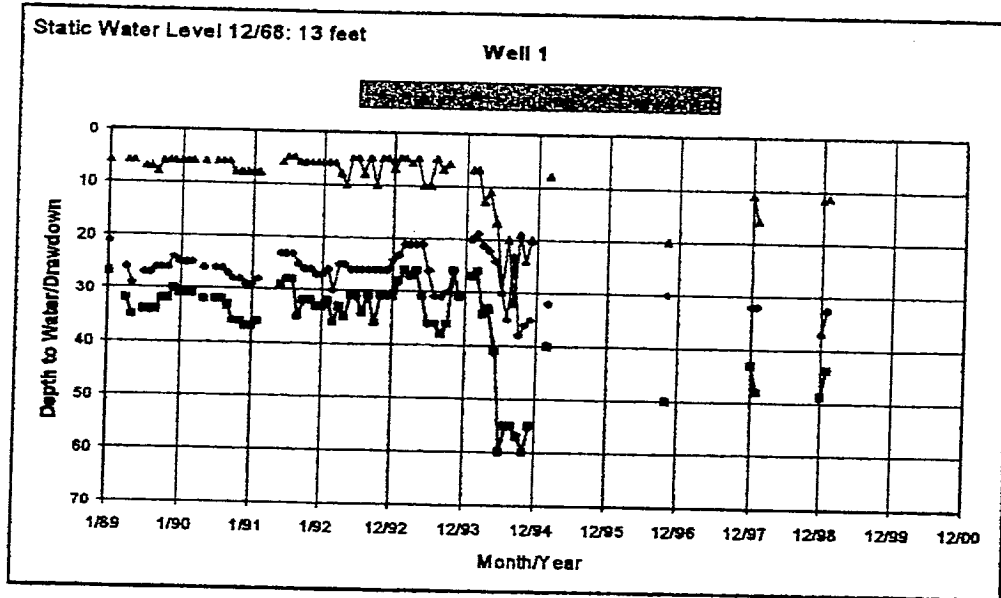
As with any piece of equipment, the City's wells and pumps require periodic upkeep in order to maintain their design capacity and efficiency. Maintaining the design capacity of the wells ensures that they will be able to meet water demands. Maintaining the efficiency of the wells is important because it directly affects the consumption of energy and the cost of operating the system.

For well maintenance to be effective, it is imperative to be able to identify when, and what part of, the well is "breaking down". This information can be provided by systematically monitoring and analyzing some key operating parameters. The Mason Public Utilities Department collects some of this information (see graph next page). However, the full benefit of this effort is not being realized because not enough

City of Mason

Well Field Management Program

information is being collected and the information is not being collected using consistent methods, nor on a routine basis.



On August 4, 1999, Malcolm Pirnie and key personnel from the Mason Water Department held a Water Supply Well Management Workshop. During the workshop, the concepts of aquifer yield and well management and some preliminary ideas for upgrading the City's well maintenance program were discussed. This proposal adds to those discussions and presents recommendations for upgrading the City's current well field maintenance program.

Aquifer Water Levels

Since the workshop, additional concerns regarding the declining water levels in the aquifer have arisen. Several residents in the vicinity of the water treatment plant have complained of periodic losses of water in their wells this summer. In response to these complaints, the Ohio Department of Natural Resources - Division of Water conducted a field investigation of the aquifer levels on August 20, 1999. A Technical Report was issued on October 1, 1999, outlining their findings and conclusions. In addition, the issue was made public through several recent newspaper articles.

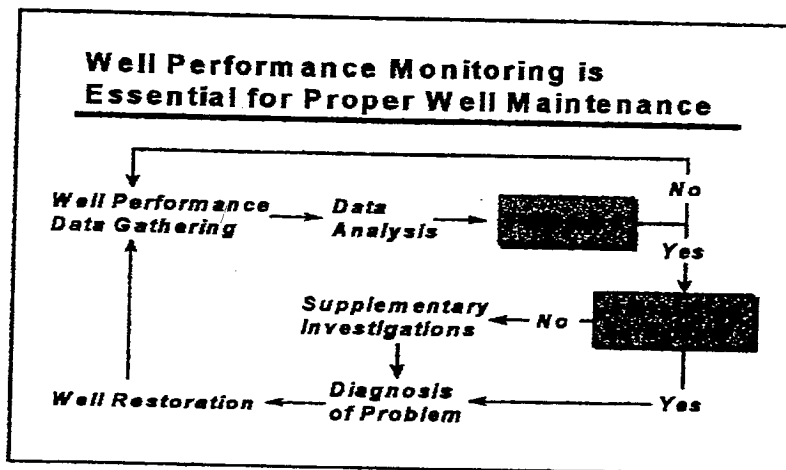
We believe that it would be prudent for the City to formally address the ODNR report and public concerns. Therefore, we propose to provide an evaluation of the aquifer to determine the safe yield for the City. This evaluation would be conducted as a precursor to the development of the well field management program.

WELL FIELD MANAGEMENT PROGRAM DESCRIPTION

Well Performance Monitoring

Water supply wells naturally deteriorate with time. This deterioration often develops slowly, sometimes without being noticed. Once a critical point is reached, deterioration becomes rapid, resulting in a substantial decrease in yield. If deterioration continues unnoticed, catastrophic failure that can be costly to repair may result. The proper operation of wells requires up-to-date and accurate well performance records. These records provide the basis for determining trends in the deterioration of well performance and for diagnosing well problems.

The figure shown below illustrates the role of well performance monitoring in the context of well maintenance. The process begins with gathering well performance data, which are subsequently analyzed in a manner that will alert operators to the onset of problems. If no problems are detected, monitoring continues. If the analysis does indicate a problem, the well performance data (and possibly supplemental data) are used to develop a restoration program that addresses the specific problem(s). After completing well restoration, monitoring is resumed in order to evaluate the effectiveness of the restoration techniques employed.



Benefits of a Comprehensive Well Field Maintenance Program

Information from a comprehensive Well Field Maintenance Program will provide the City of Mason with the basis for making better and more cost-effective decisions regarding the operation and maintenance of their well field. Specifically, the benefits provided by the program include:

- 1) Increased value of dollars spent on well maintenance by identifying and focusing on the wells that are in greatest need of receiving maintenance.
- 2) Reduced maintenance costs by providing an early warning of problems before they result in well/pump failures.

- 3) Optimized well rehabilitation by providing the means for evaluating the effectiveness of various well rehabilitation techniques.
- 4) Enhanced well field performance by providing objective data that can be used to identify operating inefficiencies, including declining static water levels, and their possible solutions.
- 5) Quantitative assessment of the need for additional or replacement wells, and provision of new well design information.

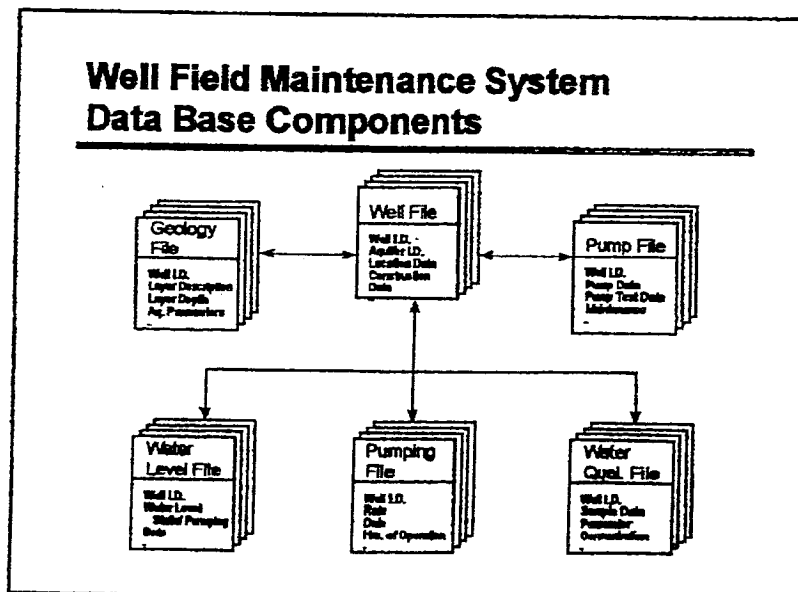
Well Performance Data Collection

Implementing a well maintenance program that uses the process illustrated above requires a system for collecting, analyzing, and evaluating well performance data. The methods for collecting well performance monitoring data range from simple manual techniques to more sophisticated automated systems, such as SCADA systems.

We recommend the City monitor the following well performance parameters.

- hours of operation
- pumping rate and volume
- static and pumping water levels
- discharge pressure
- input electrical current
- conduct annual pumping tests

These data, along with other relevant information such as well construction, pump installation, and hydrogeologic data, should be combined to create a Well Field Management database (illustrated in the figure).

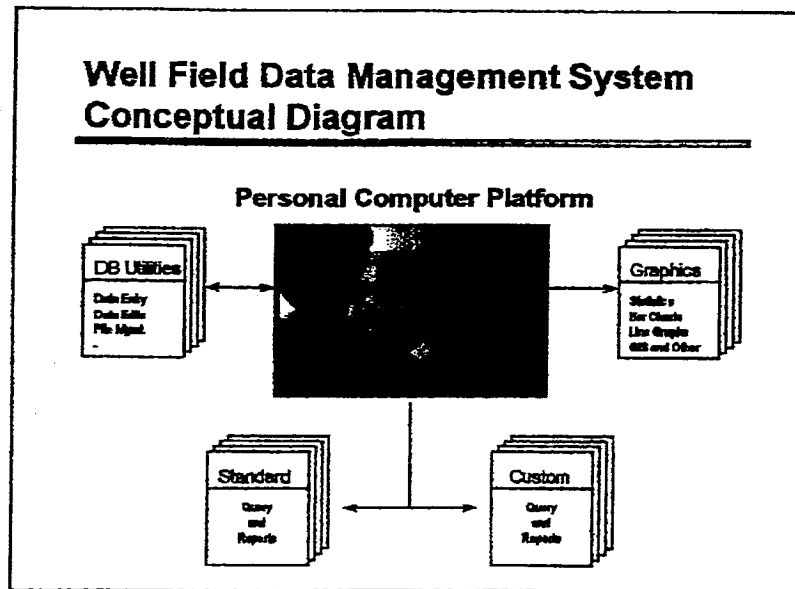


In addition, data gathering standards and protocols should be developed to ensure the well performance data being collected are consistent. This is particularly important because most of the data evaluations involve a comparative analyses (i.e., data collected over time are compared in order to identify trends and/or anomalies).

Well Performance Data Analysis and Evaluation

The analysis and evaluation of well performance monitoring data in a timely manner is essential for detecting excessive deterioration of wells. A computer-based system is recommended to allow the City to perform these functions quickly and with minimal effort. The system, illustrated on the diagram below, will generally perform three functions:

- 1) Data Management – utilities to enter, edit, manipulate, store, and retrieve data,
- 2) Data Analysis – routines to conduct standard and custom database queries and generate reports, and;
- 3) Data Evaluation – programs to perform statistical operations and trend analyses, and display results in a variety of formats.



On the basis of the City's commitment to use Microsoft Office applications, we recommend the Well Field Data Management System be developed using Microsoft Access and Excel. Together, these software packages can be programmed to perform the necessary functions efficiently and effectively.

PROJECT APPROACH

The recommended project approach consists of a two-phased approach with two tasks in each phase, which are described below. Task II-B includes options for level of refinement. The level of refinement refers to the level of effort on behalf of Malcolm Pirnie and the level of sophistication of the computerized components of the program. Program costs based on level of refinement are presented in the section following this one.

Phase I – Aquifer Evaluation

The first phase of the project will focus on the evaluation of the aquifer. We will review the hydrogeologic and well data, then evaluate the data along with other relevant information, such as previous reports. We will compile our findings and recommendations into a report for submittal to the City.

Task I-A – Hydrogeologic and Well Data Review: The existing data for all wells and water production information will be reviewed and entered into an electronic database (Microsoft Access/Excel). This information will include hours of operation, pumping rate and volume, static and pumping water levels, discharge pressure, input current, annual pumping tests, well construction and maintenance information, pump installation and maintenance information, and hydrogeologic data, and the production data from the other utilities drawing from the aquifer.

Task I-B – Well Field and Aquifer Evaluation and Recommendations: All well data will be evaluated along with other relevant information, including the following reports:

- Groundwater Investigation Report developed by the Ohio Department of Natural Resources – Division of Water
- Draft report currently being developed by Dr. Nash, University of Cincinnati
- 1994 Wellhead Protection Plan by CH2M Hill

On the basis of this evaluation, Malcolm Pirnie will address the City's current concerns about declining water levels. This evaluation will include estimates of the sustainable yield of the Shaker Creek aquifer system and recommendations on mitigating the impact of declining water levels in the future. A ground water flow model will be used in the evaluation. Malcolm Pirnie will also make recommendations regarding the need to install an additional water supply well (Well 9) and whether to keep existing Wells 1 and 2 in service. In addition, recommendations will be presented regarding the monitoring wells being planned for in conjunction with the City's Wellhead Protection Program.

Phase II – Well Field Management Program Development

The second phase of the project will be the development of a well field management program. We will develop protocols and forms to be used by the City's for collection of well field performance data. We will also develop a computerized interface at one of three levels of refinement based on the City's needs.

Task II-A - Well Field Performance Data Collection: Protocols and forms for collecting well performance monitoring parameters will be developed. Parameters will include hours of operation, pumping rate and volume, static and pumping water levels, discharge pressure, input current, and annual pumping tests. We will also recommend a monitoring frequency for each parameter. The protocols and forms will be integrated into the computerized system developed in Task II-B.

Task II-B - Well Field Management System Interface: A computerized interface will be developed using Microsoft Access/Excel. The interface will provide access to historical information, include electronic forms for entering new information. The interface will also include analytical tools to assist in the evaluation of the well performance information. We will also provide support during the installation of the system, initial start-up, and de-bugging of the system.

Options for Level of Refinement for computerized interface system:

- Low – Excel spreadsheet in workbook format.
- Moderate – Excel spreadsheet in workbook format with Macros.
- High – Graphical user interface that integrates site maps using geographical information systems (GIS), Excel spreadsheets, and Access relations database components.

PROJECT COST AND SCHEDULE

The different levels of refinement relate to Task II-B. The fees and schedule duration for Tasks I-A, I-B, and II-A are the same for each level of Task II-B refinement.

Range of Estimated Fees Based on Level of Refinement

Phase I – Aquifer Evaluation:

Task I-A: Data Review	\$6,000
Task I-B: Evaluation and Recommendations	\$20,000
Phase I Subtotal:	\$26,000

Phase II – Well Field Management Program

	Level of Refinement		
	<u>Low</u>	<u>Moderate</u>	<u>High</u>
Task II-A: Well Field Performance Data Collection	\$3,000	\$3,000	\$3,000
Task II-B: Well Field Management System Interface	\$9,000	\$17,000	\$23,000
Phase II Subtotals:	<u>\$12,000</u>	<u>\$20,000</u>	<u>\$26,000</u>
Totals:	\$38,000	\$46,000	\$52,000

Preliminary Schedule Based on Level of Refinement

We anticipate that Phase I, Aquifer Evaluation, will be completed within 10 to 12 weeks after notice to proceed from the City. Phase II, Well Field Management Program, will take an additional 8 to 14 weeks depending on the level of refinement selected by the City.

**MALCOLM
PIRNIE****MALCOLM PIRNIE, INC.
ENVIRONMENTAL ENGINEERS, SCIENTISTS & PLANNERS**

October 5, 1999

R. Ernest Stickler
Public Utilities Superintendent
City of Mason
202 West Main Street
Mason, Ohio 45040-1699

Re: Revised Proposal for Well Field Management Program

Dear Ernie:

We are pleased to submit our revised proposal for services related to the development of a Well Field Management Program. This proposal is based on information from the Water Supply Well Management Workshop held with the City on August 4, 1999, and subsequent discussions.

The proposed project has evolved into a more comprehensive project than was originally envisioned during the Workshop held on August 4, 1999. Given the City's concern over declining water levels in the Shaker Creek aquifer and the proposed additional well field development by Warren County, Malcolm Pirnie has incorporated other major issues pertaining to the aquifer into the scope of work for the proposed project.

Since we submitted our original proposal on August 31, 1999, the Ohio Department of Natural Resources issued a Technical Report outlining their findings and conclusions from their recent field investigation. As you requested, we revised our proposal to provide a more comprehensive evaluation of the entire Shaker Creek aquifer in response to the ODNR report and additional public concerns.

We propose to provide an evaluation of the aquifer as Phase I of the project. The issues that will be addressed include:

- A sustainable yield evaluation of the aquifer and the City's well field.
- An evaluation of an additional new supply well (Well No. 9).
- The placement of monitoring wells in the vicinity of the well field.
- An evaluation of historic static water levels in the Shaker Creek aquifer.

**MALCOLM
PIRNIE**

R. Ernest Stickler
City of Mason

October 5, 1999
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Our findings and recommendations will be compiled into an aquifer evaluation report. This information is extremely important and will assist the City in making educated decisions regarding the long-term use of this valuable resource.

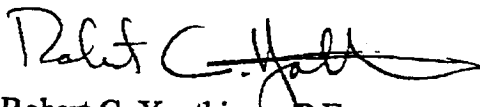
The development of the Well Field Management Program will be developed as Phase II of the project. The major benefits of implementing a Well Field Management Program include cost savings by identifying and focusing only on the wells that are in the greatest need of maintenance and providing early warning of problems before they result in costly well/pump failures. Other benefits include optimized well rehabilitation, enhanced well field performance, and a better understanding of how the wells affect the aquifer.

We appreciate the opportunity to assist the City of Mason with the development of a Well Field Management Program. We would like to further discuss this proposal with you, particularly the various levels of refinement available for the development of the Well Field Management System Interface (Task II-B). After our discussions, we will develop a new Task Order under our Master Services Agreement, based on a mutually acceptable scope and fee.

If you have any questions regarding this proposal or need additional information, please let us know.

Very truly yours,

MALCOLM PIRNIE, INC.



Robert C. Yoxthimer, P.E.
Senior Associate
Branch Manager

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Enclosure

c. T. Holdeman, w/encl