

2003 Project Abstract

For the Period Ending June 30, 2005

TITLE: Intercommunity Groundwater Protection "Sustaining Growth and Natural Resources"
PROJECT MANAGER: Amanda Goebel
ORGANIZATION: Washington County Public Health & Environment
ADDRESS: 14949 62nd Street North, PO Box 6, Stillwater, MN 55082
WEB SITE ADDRESS: www.co.washington.mn.us and <http://www.barr.com/clientre/clientre.asp>
FUND: Minnesota Environment and Natural Resources Trust Fund
LEGAL CITATION: ML 2003, Ch. 128, Art. 1, Sec. 9, Subd. 07c

APPROPRIATION AMOUNT: \$125,000

Overall Project Outcome and Results

The primary purpose of the project was to develop a hydrologic model that can be used to evaluate the "sustainability" of groundwater withdrawals in the Woodbury-Afton area of Washington County.

The overall product of this project is a calibrated computer groundwater flow model of the major aquifers in southern Washington County. This groundwater model is a tool to predict the effects of proposed groundwater withdrawals (pumping) on: groundwater levels and pressures; water levels in existing wells; and base flows into Valley Creek (a designated trout stream). The primary impetus for this groundwater model is to predict the effects of proposed water-supply wells that are planned for the western portion of the City of Woodbury.

Additional products of this project include: GIS files of model parameters and results; a web site with interim products; model input and output files; and a final report (Barr Engineering and Washington County, 2005. Intercommunity Groundwater Protection, Sustaining Growth and Natural Resources, in the Woodbury/Afton Area).

Project Results Use and Dissemination

The groundwater flow model was used to predict the future effects of pumping of City of Woodbury wells 15, 16, and 17 on groundwater levels and base flows into Valley Creek. The modeling results suggest that for most pumping conditions, the reduction in the base flow of Valley Creek will likely be too small to accurately measure (within the range of measurement error). This small reduction in base flow due to pumping will most likely be limited to the south branch of Valley Creek, rather than the north branch or the main reach that flows into the St. Croix River. In general, the maximum reduction in base flows will occur in the summer months and will be about 0.5 cubic feet per second, which is about 5 to 15 percent of typical summer base flow or about 10 cubic feet per second. Flow from surface runoff would likely further mask this effect.

During extremely dry conditions base flows will be lower in Valley Creek (particularly the south branch) because of climatic conditions and regional pumping. The reduced base flow to the south branch of Valley Creek will likely be about 0.5 cubic feet per second. While this may not initially seem significant, this reduction might cause the upper portions of the south branch to have low or no base flow for a short period until pumping is reduced and water levels rebound. The model was developed to allow interested groundwater scientists and engineers can to the model to evaluate new information.

Date of Report: July 28, 2005
LCMR Final Work Program Report

I. PROJECT TITLE: Intercommunity Groundwater Protection "Sustaining Growth and Natural Resources"

Project Manager: Amanda Goebel

Affiliation: Washington County Public Health and Environment

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Total Biennial LCMR Project Budget:

| | | |
|----------------------------|-----------|-------------------|
| LCMR Appropriation: | \$ | 125,000.00 |
| Minus Amount Spent: | \$ | 124,998.03 |
| Equal Balance: | \$ | 1.97 |

Legal Citation: ML 2003, Chap. 128, Article 1, Sec. 9, Subd 07(c).

Appropriation Language

7 (c) Intercommunity Groundwater Protection

\$62,000 the first year and \$63,000 the second year are from the trust fund to the commissioner of natural resources for an agreement with Washington county for groundwater monitoring, modeling, and implementation of management strategies.

II. and III. FINAL PROJECT SUMMARY:

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IV. OUTLINE OF PROJECT RESULTS:

Result 1: Monitoring Network Developed and Data Collected

Monitoring of groundwater systems and associated trout, lake and wetland habitat provided essential data to build upon the platform of the integrated modeling environment MIKE SHE using the Metro Model to establish outer boundaries and line sinks. Aquifer, lake, wetland and stream levels were measured at new and existing locations. The Metro Model, along with existing groundwater models, well logs, surface and groundwater level data, aquifer characteristics, geology, stream flow, and precipitation data was compiled. Automated data loggers and computer cabling for monitoring water levels were purchased for two monitoring wells.

There was also coordination with the Minnesota Geological Survey to acquire fault zone and bedrock elevation data and flow logging of any additional pumping tests. This project closely integrates with the "Integrating Groundwater and Surface Water Management-Southern Washington County Study". That study was funded by a Minnesota Board of Soil & Water Resources Challenge Grant which is supported by LCMR funds. This regional monitoring network will operate into the future to evaluate impacts to natural resources and the performance of groundwater management strategies.

Summary Budget Information for Result 1: LCMR Budget \$37,500.00
 Balance \$ 1.97

Result 2: Computer Model Output: Predictions of Groundwater Use on Aquifer Sustainability and Natural Resources

The MIKE SHE-MODFLOW model was constructed and calibrated using automated inverse optimization methods. Infiltration was simulated for climatological conditions experienced in 1988 through 2002, as well as for typical conditions (represented by 1979 conditions). These infiltration rates were compiled into monthly mean values on 100-meter grids for the study area. Using these data, further groundwater model calibration was performed. The calibrated model was then used to evaluate the potential effects of pumping of Woodbury wells 15, 16, and 17 on groundwater levels and base flows to Valley Creek. The period 2005 through 2020 was simulated. Groundwater use projections were made on the basis of projected population growth and assumed that climatic conditions similar to the period 1988 through 2002 would occur. The model produced output on groundwater level fluctuations at key locations and on the groundwater contribution of base flow to the south branch, north branch, and main branches of Valley Creek. The model simulations predicted that the pumping of these wells would have a very small effect on base flows of Valley Creek but that these effects would be most felt on the south branch of the Creek. However, the predicted changes in base flow, compared to current conditions, would like be too small to be measurable by standard flow gauging methods. The model files were compiled, along with accompanying GIS files in order to make future use of the model as efficient as possible.

Summary Budget Information for Result 2: LCMR Budget \$80,500.00
 Balance \$ 0.00

Result 3: Report: "Intercommunity Groundwater Protection, Sustaining Growth and Natural Resources"

A detailed final report, with CDs containing model and GIS files, was prepared. The report includes 93 color figures and detailed description of files and model construction. The results from the simulations of the Woodbury wells are also included. Presentations and meeting minutes, along with files and the report are posted to the web site where they will continue to be accessible. The document also can provide vital guidance to the Department of Natural Resources and the Valley Branch Watershed District for issuing groundwater appropriations permits. The methodologies, modeling and integrated science and policy efforts will serve as a pilot for sustainable groundwater management state-wide.

Summary Budget Information for Result 3: LCMR Budget \$7,000.00
 Balance \$ 0.00

V. TOTAL LCMR PROJECT BUDGET

All Results: Personnel: \$114,000

All Results: Equipment: \$ 4,000

All Results: Development: \$

All Results: Acquisition: \$

All Results: Other (Printing & Web page development): \$ 7,000

TOTAL LCMR PROJECT BUDGET: \$125,000

Explanation of Capital Expenditures Greater Than \$3,500: N/A

VI. PAST, PRESENT AND FUTURE SPENDING:

A. Past Spending:

City of Woodbury - \$110,025; July 1, 2001 – June 30, 2003

City of Afton – In-kind \$1250

Valley Branch Watershed District – Watershed District Funds & Watershed Outlet Monitoring Program (WOMP); July 1, 2001 – June 30, 2003; \$20,060.

South Washington Watershed District – Watershed District Funds; July 1, 2001 – June 30, 2003; \$300,500.

Washington County – In kind \$2500

Department of Natural Resources – In kind \$2500

B. Current Spending:

City of Woodbury - \$144,250

City of Afton –\$2500 in kind

City of Oakdale - \$2500 in kind

City of Lake Elmo - \$2500 in kind

Valley Branch Watershed District - \$57,800

South Washington Watershed District – \$339,500

Washington County - \$20,000 cash; \$12,500 in kind

Department of Natural Resources - \$2500 in kind

C. Required Match (if applicable) - N/A

D. Future Spending:

City of Woodbury – monitoring and modeling costs will be on-going; exact amount yet to be determined

City of Afton – participation will be ongoing; exact amount yet to be determined

Valley Branch Watershed District – monitoring costs will be on-going; exact amount yet to be determined

South Washington Watershed District - monitoring costs will be on-going; exact amount yet to be determined

Washington County – participation and facilitation will be ongoing; exact amount yet to be determined

Department of Natural Resources – continued oversight of appropriations permit

VII. Project Partners

A. Partners Receiving LCMR Funds – The funds will be directed toward the cost for groundwater and surface water monitoring/sampling, the costs to input the data into the mathematical groundwater model, the cost of running various development scenarios from the model, and the cost to write and disseminate the report, including web based dissemination. At this time, it is not anticipated any of the partners will directly receive the LCMR funds.

B. Project Cooperators

City of Woodbury – Steve Kernik, City Planner

City of Afton – Mitch Berg, City Administrator

Valley Branch Watershed District – John Hanson, Watershed Engineer

South Washington Watershed District – Matt Moore, Watershed Administrator

Washington County – Amanda Goebel, Senior Environmental Specialist and Cindy Weckwerth, Program Manager

Department of Natural Resources – Todd Petersen, Travis Germundson, and Evan Drivas, DNR Waters

VIII. DISSEMINATION: Data, findings, and model policies will be provided in a final report that will be available both in written form and from a web site. The web site will be developed as information added to the website as the project progresses. Informational meetings with stakeholders and to other interested parties will be held.

IX. LOCATION: Washington County; Cities of Afton (portions of zip code 55001) and Woodbury (portions of zip code 55129); work will take place in the eastern portion of Woodbury and the western portion of Afton.

X. REPORTING REQUIREMENTS: Periodic work program progress reports will be submitted not later than December 31, 2003, June 1, 2004, and December 31, 2004. A final work program report and associated products will be submitted by August 5, 2005

XI. RESEARCH PROJECTS: N/A.

Attachment A: Budget Detail for 2003 Projects

Proposal Title: *Intercommunity Groundwater protection - Sustaining Growth and Natural Resources 07c*

Project Manager Name: Amanda Goebel

LCMR Requested Dollars: \$125,000

| 2003 LCMR Proposal Budget | Result 1 Budget: | Amount Spent (6/30/05) | Balance (6/30/05) | Result 2 Budget: | Amount Spent (6/30/05) | Balance (6/30/05) | Result 3 Budget: | Amount Spent (6/30/05) | Balance (6/30/05) | Project Total: | Balance (6/30/05) |
|--|--|---------------------------|-------------------|--|---------------------------|-------------------|---|---------------------------|----------------------|------------------------------|----------------------|
| | <i>Monitoring Network Developed and Data Collected</i> | | | <i>Computer Model Output: Predictions of Groundwater Use on Aquifer Sustainability and Natural Resources</i> | | | <i>Report: Intercommunity Groundwater Supply Plan - Sustaining Growth & Natural Resources</i> | | | | |
| BUDGET ITEM | | | | | | | | | | TOTAL FOR BUDGET ITEM | |
| PERSONNEL: Staff Expenses, wages, salaries | | | | | | | | | | | |
| PERSONNEL: Staff benefits | | | | | | | | | | | |
| Contracts | | | | | | | | | | | |
| <i>Professional/technical - Project Consultant for detailed surface water and groundwater monitoring plan, mathematical groundwater modeling, data collection, reporting (consultant will be selected through RFQ process & standard LCMR agreement format will be used)</i> | \$31,500.00 | \$31,498.03 | \$1.97 | \$80,500.00 | \$80,500.00 | \$0.00 | \$2,000.00 | \$2,000.00 | \$0.00 | \$114,000.00 | \$1.97 |
| <i>Other contracts (with whom?, for what?) list out:</i> | | | | | | | | | | | |
| Space rental: NOT ALLOWED | X | | | X | | | X | | | X | |
| <i>Equipment / Tools - rental of groundwater/ surface water monitoring equipment</i> | \$4,000.00 | \$4,000.00 | \$0.00 | | | | | | | \$4,000.00 | \$0.00 |
| <i>Printing - Final Report</i> | | | | | | | \$3,000.00 | \$3,000.00 | \$0.00 | \$3,000.00 | \$0.00 |
| <i>Other - web page development</i> | \$2,000.00 | \$2,000.00 | \$0.00 | | | | \$2,000.00 | \$2,000.00 | \$0.00 | \$4,000.00 | \$0.00 |
| COLUMN TOTAL | \$37,500.00 | \$37,498.03 | \$0.00 | \$80,500.00 | \$80,500.00 | \$0.00 | \$7,000.00 | \$7,000.00 | \$0.00 | \$125,000.00 | \$1.97 |