FOR BOARD ACTION

Agenda Item # 4. **Meeting Date:** 1/29/08

SUBJECT:

Proposed 2008 – 2012 Groundwater Investigation Program

PREPARED BY: Todd Osweiler, Environmental Analyst, and
Doug Rovang, Senior Civil Engineer

ITEM DESCRIPTION:

From the mid-1980's to the present, the Utility Board has maintained an unwritten policy of financially supporting various hydrogeologic studies which have significantly expanded information available on the Prairie du Chien-Jordan groundwater aquifer which serves as the source of water for the City of Rochester's municipal water system. From the mid-1980's through the end of 2007, related Water Utility expenditures have totaled approximately $850,000. During that approximately twenty (20) year period, matching funds from the U.S. Geological Survey, the Minnesota Geological Survey and the Minnesota DNR have provided an additional $650,000, making approximately $1.5 million available for these worthwhile studies. A listing of technical reports resulting from those studies is provided on the next page.

At the January 29, 2008 meeting, staff will make a presentation to the Utility Board on the proposed next municipal groundwater supply aquifer-related study project. Copies of the Minnesota Geological Survey (MGS) and U.S. Geological Survey (USGS) proposals for accomplishing the proposed joint comprehensive groundwater management and groundwater/surface water interaction project for the Rochester area during the 2008-2012 time period have been provided separately to the Board.

The MGS portion of the project would be completed during 2008 at a cost to RPU of $51,948. The USGS portion of the study would extend over the 2008-2012 time period with a 2008 cost to RPU of $27,000. The Water Utility budget for 2008 includes funds for the $78,948 first year project cost. Total RPU cost for the project would be $343,948. A breakdown of proposed project costs over the five-year period and a copy of the proposed Joint Funding Agreement for the first year of the USGS portion of the project are attached. Bob Tipping from the MGS and Perry Jones from the USGS are scheduled to attend the meeting.

Staff understands that annual Utility Board approval of future-year project expenditures will be required for the project to continue.

UTILITY BOARD ACTION REQUESTED:

Staff requests the Utility Board express its support for the proposed 2008-2012 Groundwater Investigation Project, approve the MGS purchase order agreement and the USGS 2008 first-year Joint Funding Agreement, and request the Mayor and City Clerk to execute the USGS 2008 first-year Joint Funding Agreement.

Larry Kasshie — General Manager

1/24/08 — Date

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STUDY REPORTS FOR ROCHESTER'S MUNICIPAL GROUNDWATER SUPPLY SOURCE FINANCIALLY SUPPORTED BY ROCHESTER PUBLIC UTILITIES

1. Computer Hydraulic Model of the St. Peter-Prairie du Chien-Jordan Aquifer, Rochester, Minnesota, (Unpublished MODFLOW computer program developed for Rochester Public Utilities by U.S. Geological Survey following 1987-88 Groundwater Study, 1990, Geoffrey N. Delin).

2. Hydrogeology and Simulation of Ground-Water Flow in the Rochester Area, Southeastern, Minnesota, 1987-88 (U.S. Geological Survey Water-Resources Investigations Report 90-4081, 1991, Geoffrey N. Delin).

3. Delineation of Recharge Areas for Selected Wells in the St. Peter-Prairie du Chien-Jordan Aquifer, Rochester, Minnesota (U.S. Geological Survey Open-File Report 90-397, 1991, G.N. Delin and J.E. Almendinger).

4. Geologic Investigations Applicable to Ground-Water Management, Rochester Metropolitan Area, Minnesota (University of Minnesota, Minnesota Geological Survey Open-File Report 96-1, January 19, 1996, Anthony C. Runkel).

5. Hydraulic Properties and Ground-Water Flow in the St. Peter-Prairie du Chien-Jordan Aquifer, Mochester Area, Southeastern Minnesota (U.S. Geological Survey Water-Resources Investigations Report 97-4015,1997, Richard J. Lindgren).
6. Ground-Water Recharge and Flowpaths Near the Edge of the Decorah-Platteville-Glenwood Confining Unit, Rochester, Minnesota (U.S. Geological Survey Water-Resources Investigations Report 00-4215, 2001, Richard J. Lindgren).

7. Evaluating the Effects of Vegetative Buffers Along the Edge of the Decorah Shale, Rochester, Minnesota (2002-2007 U.S. Geological Survey Water-Resources Investigation Report – In Preparation, Perry M. Jones).

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ROCHESTER PUBLIC UTILITIES
PROPOSED GROUNDWATER PROJECT FUNDING (2008 - 2012)

Minnesota Geological Survey Proposed Portion of Project:
Geologic Investigations Applicable to Groundwater Management Concerns in the Rochester Metropolitan Area.

	Proposed Financial Contributions to Project					
	2008	2009	2010	2011	2012	
Rochester Public Utilities -	$ 51,948	$ -	$ -	$ -	$ -	$ 51,948
Minnesota Geological Survey -	$ -	$ -	$ -	$ -	$ -	$ -
Total Funding for Project -	$ 51,948	$ -	$ -	$ -	$ -	$ 51,948

U.S. Geological Survey Proposed Portion of Project:
Assessment of Groundwater Flow, and Groundwater and Surface Water Interaction in the Rochester Area, MN.

Cooperating Agencies	Proposed Financial Contributions to Project					
	FY2008	FY2009	FY2010	FY2011	FY2012	Total
Rochester Public Utilities -	$ 27,000	$ 75,000	$ 80,000	$ 85,000	$ 25,000	$ 292,000
U.S. Geological Survey -	$ 25,000	$ 50,000	$ 55,000	$ 60,000	$ 15,000	$ 205,000
Total Funding for Project -	$ 52,000	$ 125,000	$ 135,000	$ 145,000	$ 40,000	$ 497,000

Project Funding Summary:

Rochester Public Utilities -	$ 78,948	$ 75,000	$ 80,000	$ 85,000	$ 25,000	**$ 343,948**
Minnesota Geological Survey -	$ -	$ -	$ -	$ -	$ -	**$ -**
U.S. Geological Survey -	$ 25,000	$ 50,000	$ 55,000	$ 60,000	$ 15,000	**$ 205,000**
Total for Project -	$ 103,948	$ 125,000	$ 135,000	$ 145,000	$ 40,000	**$ 548,948**

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United States Department of the Interior

U. S. GEOLOGICAL SURVEY
Water Science Center of Minnesota
2280 Woodale Drive.
Mounds View, MN 55112-4900
Tel: (763) - 783 - 3100
DUNS: 091721100

January 16, 2008

Doug Rovang
City of Rochester
Rochester Public Utilities
4000 East River Road NE
Rochester, MN 55906

Dear Doug,

The U.S. Geological Survey is pleased to join in cooperation with the City of Rochester, Rochester Public Utilities these efforts outlined in the Joint Funding Agreement.

We are sending you three copies of the Joint Funding Agreement to confirm our negotiations for the project titled "Assessment of Ground-Water Flow and Ground-Water and Surface-Water Interaction in the Rochester Area, MN". Please sign both originals; return one signed original and retain the other original for your records.

Work performed with funds from this agreement, $27,000 for the period of January 1, 2008 through September 30, 2008, will be conducted on a fixed-price basis. The City of Rochester will be billed on a quarterly basis. The results of all work under this agreement will be available for publication by the U.S. Geological Survey.

If you have any questions, please feel free to call Marre Jo Sager at 763/783-3120, or e-mail sager@usgs.gov. Questions regarding the project may be directed to Perry Jones, 763/783-3253, email pmjones@usgs.gov.

Sincerely,

James R. Stark

James R. Stark
Acting Director

Attachments

Form 9-1366
(Oct. 2005)

U.S. Department of the Interior
U.S. Geological Survey
Joint Funding Agreement

Page 1 of 2

Customer #:	MN063
Agreement #:	08C4MN860701700
Project #:	8-8607-DAW00
TIN #:	41-6005494
Fixed Cost Agreement	☑ Yes ☐ No

FOR
WATER RESOURCES INVESTIGATIONS

THIS AGREEMENT is entered into as of the 1st day of January, 2008, by the U.S. GEOLOGICAL SURVEY, UNITED STATES DEPARTMENT OF THE INTERIOR, party of the first part, and the City of Rochester, party of the second part.

1. The parties hereto agree that subject to availability of appropriations and in accordance with their respective authorities there shall be maintained in cooperation the project entitled "Assessment of Ground-Water Flow and Ground-Water and Surface-Water Interaction in the Rochester Area, MN", herein called the program. The USGS legal authority is 43 USC 36C; 43 USC 50; and 43 USC 50b.
2. The following amounts shall be contributed to cover all of the cost of the necessary field and analytical work directly related to this program. 2(b) includes In-Kind Services in the amount of $0.

(a) $25,000 by the party of the first part during the period January 1, 2008 **to** September 30, 2008

(b) $27,000 by the party of the second part during the period January 1, 2008 **to** September 30, 2008

(c) Additional or reduced amounts by each party during the above period or succeeding periods as may be determined by mutual agreement and set forth in an exchange of letters between the parties.

(d) The performance period may be changed by mutual agreement and set forth in an exchange of letters between the parties.

3. The costs of this program may be paid by either party in conformity with the laws and regulations respectively governing each party.
4. The field and analytical work pertaining to this program shall be under the direction of or subject to periodic review by an authorized representative of the party of the first part.
5. The areas to be included in the program shall be determined by mutual agreement between the parties hereto or their authorized representatives. The methods employed in the field and office shall be those adopted by the party of the first part to insure the required standards of accuracy subject to modification by mutual agreement.
6. During the course of this program, all field and analytical work of either party pertaining to this program shall be open to the inspection of the other party, and if the work is not being carried on in a mutually satisfactory manner, either party may terminate this agreement upon 60 days written notice to the other party.
7. The original records resulting from this program will be deposited in the office of origin of those records. Upon request, copies of the original records will be provided to the office of the other party.

Page 2 of 2

Form 9-1366 continued	U.S. Department of the Interior U.S. Geological Survey Joint Funding Agreement	Customer #: Agreement #: Project #: TIN #:	MN063 08C4MN860701700 8-8607-DAW00 41-6005494

8. The maps, records, or reports resulting from this program shall be made available to the public as promptly as possible. The maps, records, or reports normally will be published by the party of the first part. However, the party of the second part reserves the right to publish the results of this program and, if already published by the party of the first part shall, upon request, be furnished by the party of the first part, at costs, impressions suitable for purposes of reproduction similar to that for which the original copy was prepared. The maps, records, or reports published by either party shall contain a statement of the cooperative relations between the parties.
9. USGS will issue billings utilizing Department of the Interior Bill for Collection (form DI-1040). Billing documents are to be rendered **quarterly**. Payments of bills are due within 60 days after the billing date. If not paid by the due date, interest will be charged at the current Treasury rate for each 30 day period, or portion thereof, that the payment is delayed beyond the due date. (31 USC 3717; Comptroller General File B-212222, August 23, 1983).

U.S. Geological Survey
United States
Department of the Interior

USGS Point of Contact

Name: Perry Jones
Address: 2280 Woodale Drive
Mounds View, MN 55906
Telephone: 763-783-3253
Email: pmjones@usgs.gov

Signatures

By James R. Stark Date 1/15/08
Name: James R. Stark
Title: Acting Director

By_____ Date_____
Name:
Title:

By_____ Date_____
Name:
Title:

City of Rochester

Customer Point of Contact

Name: Doug Rovang
Address: 4000 East River Road NE
Rochester, MN 55906
Telephone: 507-280-1605
Email: drovang@rpu.org

Signatures

By_____ Date_____
Name: Ardell Brede
Title: Mayor

By_____ Date_____
Name: Judy Scharr
Title: City Clerk

By_____ Date_____
Name: Terry Adkins
Title: City Attorney

By_____ Date_____
Larry Koshire
RPU General Manager

Combined

Minnesota Geological Survey

and

U.S. Geological Survey

ASSESSMENT OF GROUNDWATER FLOW, AND GROUNDWATER/SURFACE WATER INTERACTION STUDY PROPOSALS, ROCHESTER AREA, MINNESOTA

(2008 – 2012)

(Including Cooperating Agencies Budget Summary)

January, 2008

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CONTENTS

Rochester Public Utilities, 4000 East River Road NE, Rochester, Minnesota 55906-2813
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Proposal
to
Rochester Public Utilities, Water Division
from
The Minnesota Geological Survey
University of Minnesota
for
Geologic investigations applicable to ground-water management concerns in the Rochester metropolitan area

Background

Continued growth and projected water demands for the Rochester metropolitan area have prompted Rochester Public Utilities (RPU) to pursue more detailed geologic and hydrologic information for the purposes of water supply and long-term water planning (Balaban, 1988; Runkel, 1996). Recent advances in three-dimensional mapping of bedrock units and aquifer characterization combined with improved ground-water models provide RPU with additional tools to manage ground-water supplies and to convey this information to the general public.

Rationale

A revised hydrogeologic characterization of bedrock aquifers in southeastern Minnesota (Runkel and others, 2003) has greatly improved our understanding of how water moves through these rocks. This type of information is useful for modeling of wellhead protection areas, recharge and contaminant transport. Three-dimensional mapping of bedrock hydrogeologic units, both aquifers and confining units, produces data in a grid format that is more readily transferable to ground-water flow models, providing the modeler with a more detailed hydrogeologic framework than was previously available. In addition, a three-dimensional model of the bedrock is a useful tool for conveying ground-water flow information to the general public who may not be familiar with the extent and thickness of bedrock layers and the distribution of ground-water resources.

Work Plan

The Minnesota Geological Survey proposes to conduct geologic mapping and related investigations as outlined below. A map showing the proposed study area included on page 2 of this work plan.

1. **Study area:** The investigations will be centered on Cascade, Haverhill, Marion and Rochester townships, extending into additional townships as defined by the map boundary used in Runkel, 1996 (see attached figure).

2. **Scale:** Geologic information used to create digital elevation models of bedrock hydrogeologic units will be compiled and digitized at a scale for 1: 24,000 (1 inch = 2000 feet), the standard scale of USGS 7.5 minute quadrangles. Elevations for new located or re-located wells will be assigned elevations based on their locations from 2 foot contour information provided by RPU. The cell size of final grids will be 30 meters. Expected contour interval of bedrock topography in areas with abundant data resolvable at the compilation scale will be 25 feet, 50 feet elsewhere. Geologic contacts will be constructed as part of the model building process, based on estimated unit thicknesses, but do not supercede contacts on existing geologic maps. The resulting framework model is intended for use as input for a groundwater model, and will not provide the resolution necessary for site-specific investigations.

3. **Scope:** The project will focus on the thickness and extent of bedrock attributes pertinent to ground-water issues, concerns and problems.

4. **Time frame:** All work proposed herein will be completed, and all final products delivered, 8 months from the date on which a contract between the University of Minnesota and Rochester Public Utilities is duly signed and in force. The target starting date for the Minnesota Geological Survey is February 1st, 2008, with final products delivered by September 30th, 2008.

5. **Deliverables:**

   (a) **Database map**, which will show the locations of all water wells, engineering borings, and outcrops used in compiling bedrock surface elevations.

   (b) **Updated CWI database**, which will contain verified location and geologic interpretations of all water well logs used in the study. An additional dataset will include locations and geologic interpretations of all engineering borings that were used. Locations of wells already in CWI will be updated by location information provided by RPU. Elevation data for these wells will also be updated by comparing revised locations to two foot contour elevation data provided by the county.

   (c) **Digital elevation models** of bedrock hydrogeologic units in ESRI Grid format, with accompanying metadata. Specific stratigraphic intervals included are the Stewartville, Prosser and Cummingsville Formations of the Galena Group, the Decorah Shale, the Platteville and Glenwood Formations, the St. Peter Sandstone, the Shakopee and Oneota Formations of the Prairie du Chien Group, the Jordan Sandstone, the St. Lawrence Formation, the Franconia Formation, and the Ironton-Galesville Sandstones. Grids will provide top and bottom elevations, along with thicknesses of each unit.

Personnel

The work outlined above will be carried out by seven regular professional employees of the Minnesota Geological Survey. Dale Setterholm, geologist and Associate Director, will be the project manager. He will be supported by Tony Runkel, geologist, Bob Tipping, hydrogeologist, Bruce Bloomgren, geologist, Emily Bauer, geologist, Lori Robinson, editor, and Diane Barrett, data entry person. Personnel may change due to time and staff constraints with other projects.

Budget

Salaries and fringe benefits	$50,929
Supplies (storage media, plotter paper, postage, misc.)	$650
Travel	$369
TOTAL	$51,948

Budget details are available on request.

****

References cited

Balaban, N.H., ed., 1988, Geologic Atlas, Olmsted County, Minnesota: Minnesota Geological Survey, County Atlas Series C-3, 9 plates, scale 1:100,000 and smaller.

Runkel, A.C., 1996, Geologic investigations applicable to ground-water management, Rochester metropolitan area, Minnesota: Minnesota Geological Survey, Open-File Report 96-1, 4 plates and text.

Runkel, A.C., Tipping, R.G., Alexander, E.C., Jr., Green, J.A., Mossler, J.H., and Alexander, S.C., 2003, Hydrogeology of the Paleozoic bedrock in southeastern Minnesota: Minnesota Geological Survey Report of Investigations 61, 105 p., 2 plates.

(For SPA and MGS only)

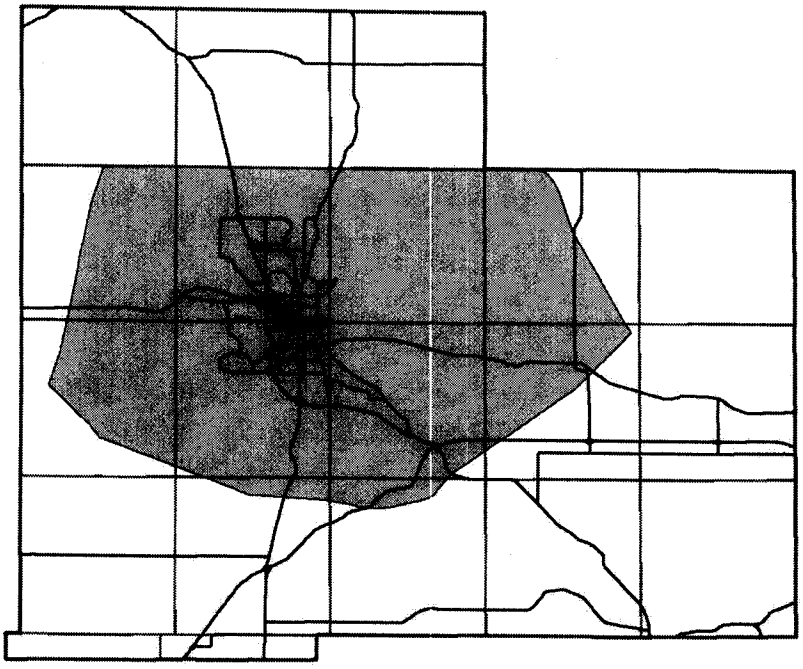
BUDGET (8 months)

Salaries	FY 07-08 Hrly	Hrs	FY 08-09 Hrly	Hrs	Tota l Hrs	Total Salary
Barrett	$14.81	160	$15.40	30	190	$2,831.67
Bauer	$24.41	52	$25.39		52	$1,269.32
Bloomgren	$30.37	140	$31.58	16	156	$4,757.16
Robinson	$21.84		$22.71	20	20	$454.27
Runkel	$30.66	230	$31.89	320	550	$17,255.45
Setterholm	$33.62	20	$34.96	20	40	$1,371.57
Tipping	$29.56	160	$30.74	166	326	$9,832.84
Student	$10.00	76	$10.40		76	$760.00
		838		572	1410	$38,532.27

Fringe Benefits		
Academic	31.60%	$433.41
Civil Service	32.70%	$11,903.03
Student	8.00%	$60.80
		$12,397.25

Other Categories

Supplies (storage media, plotter paper, postage, misc.)	$650.00
Travel	$369.00
	$1,019.00
	$51,948.52



Proposed study area. Boundary corresponds to previous mapping by Runkel, 1996.

Assessment of Groundwater Flow, and Groundwater and Surface Water Interaction in the Rochester Area, MN

Project Proposal by the
U.S. Geological Survey, Water Science Center of Minnesota
December 2007

SUMMARY

Water managers in the city of Rochester, MN are concerned about potential well interference and streamflow losses caused by municipal water withdrawals. Rochester's population and demand for water is growing at a high rate. Stream-flow losses and well interference issues are of particular concern in the eastern and southwestern portion of Rochester. To determine capture zones around the municipal wells, Rochester Public Utilities is currently using a MODFLOW steady-state simulation developed by the USGS in 1990 (Delin,1991). Over the past few years, improvements to and additional packages available to MODFLOW have increased the models ability to address the needs of local water managers. In particular, the Ground-Water Management (GWM) Process can now be applied to address several types of ground-water-management issues in Rochester, including minimizing the impact of municipal ground-water withdrawals on streamflows. RPU could use results from these optimization simulations to better determine municipal pumping configurations that minimally impact surrounding water resources, including local rivers and streams. The recently-developed streamflow-routing (SFR2) package and multi-node well (MNW) package will also allow for improved simulation of stream discharge and municipal well pumping in Rochester. The U. S. Geological Survey, working in cooperation with Rochester Public Utilities, proposes to update and improve the existing MODFLOW model using collected ground-water-level and stream discharge data, and use the upgraded model to make ground-water management predictions in the vicinity of Rochester's wells. To calibrate the new steady-state model, water-level data will be collected during synoptic water-level measurements completed in the summer of 2008 and in the winter of 2009; streamflow data will be collected in the summer of 2009. One or two management simulations will be run using the calibrated MODFLOW 2005 model and the Ground-Water Management Process package to address potential well interference and ground-water/surface-water conflicts in Rochester.

PROBLEM AND BACKGROUND

Application of Ground-water Management Process in MODFLOW 2005 to address Ground-water Management and Ground-water and Surface-water Interaction in the Rochester Area, MN

Project Proposal by the

U.S. Geological Survey, Water Science Center of Minnesota

December 2007

SUMMARY

Water managers in the city of Rochester, MN are concerned about potential well interference and streamflow losses caused by municipal water withdrawals. Rochester's population and demand for water is growing at a high rate. Stream-flow losses and well interference issues are of particular concern in the eastern and southwestern portion of Rochester. To determine capture zones around the municipal wells, Rochester Public Utilities is currently using a MODFLOW steady-state simulation developed by the USGS in 1990 (Delin,1991). Over the past few years, improvements to and additional packages available to MODFLOW have increased the models ability to address the needs of local water managers. In particular, the Ground-Water Management (GWM) Process can now be applied to address several types of ground-water-management issues in Rochester, including minimizing the impact of municipal ground-water withdrawals on streamflows. RPU could use results from these optimization simulations to better determine municipal pumping configurations that minimally impact surrounding water resources, including local rivers and streams. The recently-developed streamflow-routing (SFR2) package and multi-node well (MNW) package will also allow for improved simulation of stream discharge and municipal well pumping in Rochester. The U. S. Geological Survey, working in cooperation with Rochester Public Utilities, proposes to update and improve the existing MODFLOW model using collected ground-water-level and stream discharge data, and use the upgraded model to make ground-water management predictions in the vicinity of Rochester's wells. To calibrate the new steady-state model, water-level data will be collected during synoptic water-level measurements completed in the summer of 2008 and in the winter of 2009; streamflow data will be collected in the summer of 2009. One or two management simulations will be run using the calibrated MODFLOW 2005 model and the Ground-Water Management Process package to address potential well interference and ground-water/surface-water conflicts in Rochester.

PROBLEM AND BACKGROUND

The city of Rochester, MN is concerned about the effects of municipal ground-water withdrawals on local ground-water and surface-water supplies. Rochester is one of the faster growing cities in Minnesota, with its population increasing from 70,745 in 1990 to an estimate of 97,191 in April 2005 (U.S. Census Bureau, 2007). With this high growth rate comes an increasing demand for water. Annual municipal water usage in Rochester has increased from 3.5 billion gallons in 1986 (Delin, 1991) to 5.1 billion gallons in 2006 (Rochester Public Utilities, 2007). On a peak day of municipal water pumping, the city extracts approximately 30 million gallons (Rochester Public Utilities, 2007).

Rochester Public Utilities (RPU) is responsible for managing and maintaining the city's water supply. RPU obtains ground water from 32 wells located throughout the city and opened to Paleozoic sedimentary rocks, primarily from the St. Peter- Prairie du Chein – Jordan Aquifer (figures 1 and 2)(Rochester Public Utilities, 2007). Through assistance with the Minnesota Department of Health, RPU has delineated captures zones around each of the municipal wells and has established drinking water supply management areas around the wells (Osweiler and Blum, 2004). These delineated management areas are periodically reviewed by RPU.

Ground-water flow in the Rochester area is complex due to the heterogeneity of the bedrock aquifers. Much of the shallow ground-water flow (less than 200 feet below the top of bedrock surface) commonly occurs along secondary permeability features, such as dissolution channels, fractures, and bedding planes (Runkel and others, 2003), particularly in stream valleys. These features are commonly independent of stratigraphy, with vertical fractures and dissolution channels crossing geologic units. Water loss from local streams and rivers commonly occurs where karstic features and fractures are present and/or where ground-water withdrawal rates are high. The Shakopee Formation and upper Oneota Dolomite of the Prairie du Chien Group have well developed dissolution-enlarged fractures even at depths below several hundred feet of overlying bedrock (figure 2)(Runkel and others, 2003).

RPU is concerned about potential well interference and streamflow losses caused by municipal water withdrawals and how they may affect the delineation of drinking-water supply management areas. A drinking-water supply management area is a surface and subsurface area surrounding a public water supply well that completely contains the scientifically calculated wellhead protection area and is managed by the entity identified in a wellhead protection plan (Osweiler and Blum, 2004). Stream-flow losses and well interference issues are of concern in the eastern and southwestern portion of Rochester. To address the above issues, RPU currently uses a MODFLOW steady-state simulation developed by the USGS in 1990 (Delin, 1991) as well

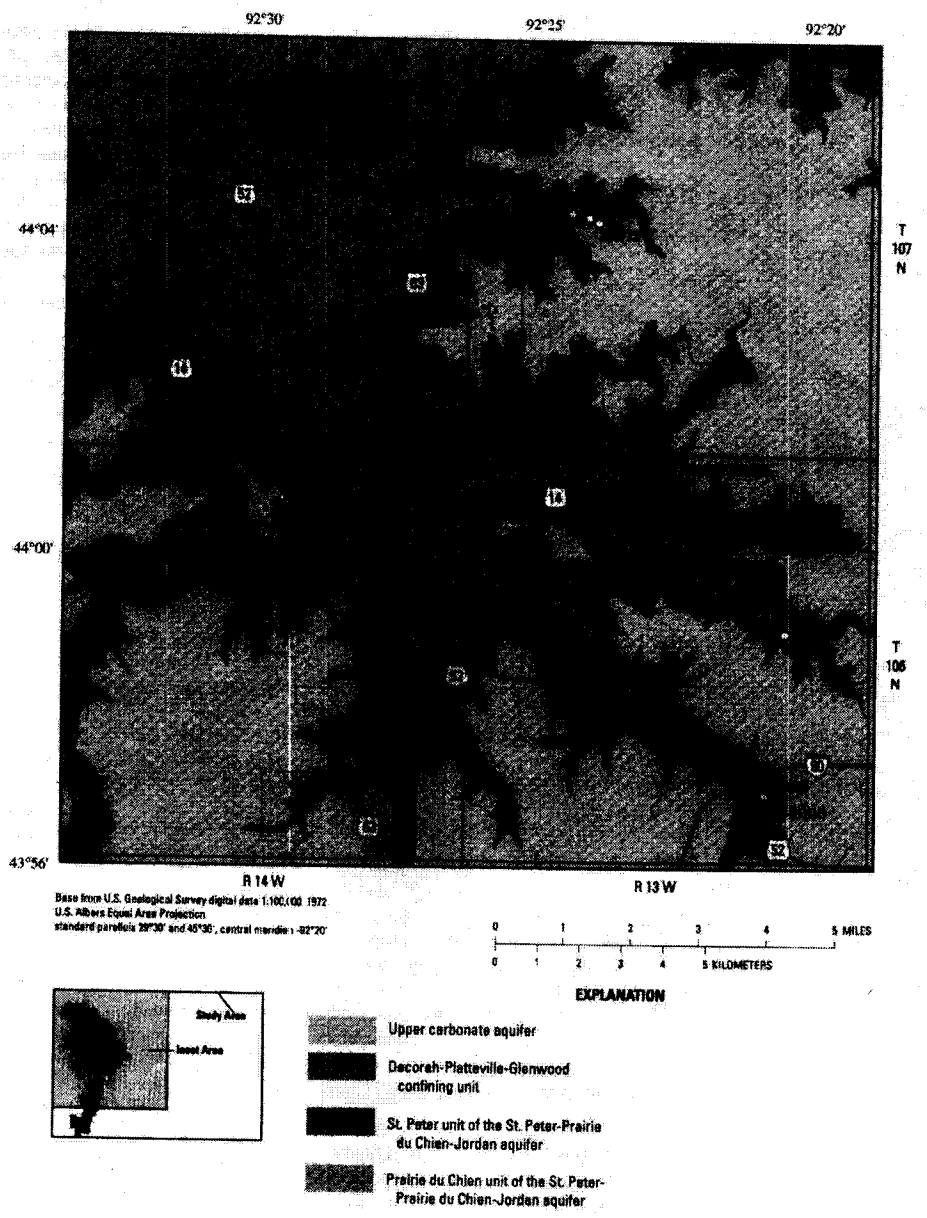


Figure 1 – Bedrock hydrogeology, Rochester area, Minnesota from Lindgren (2001).

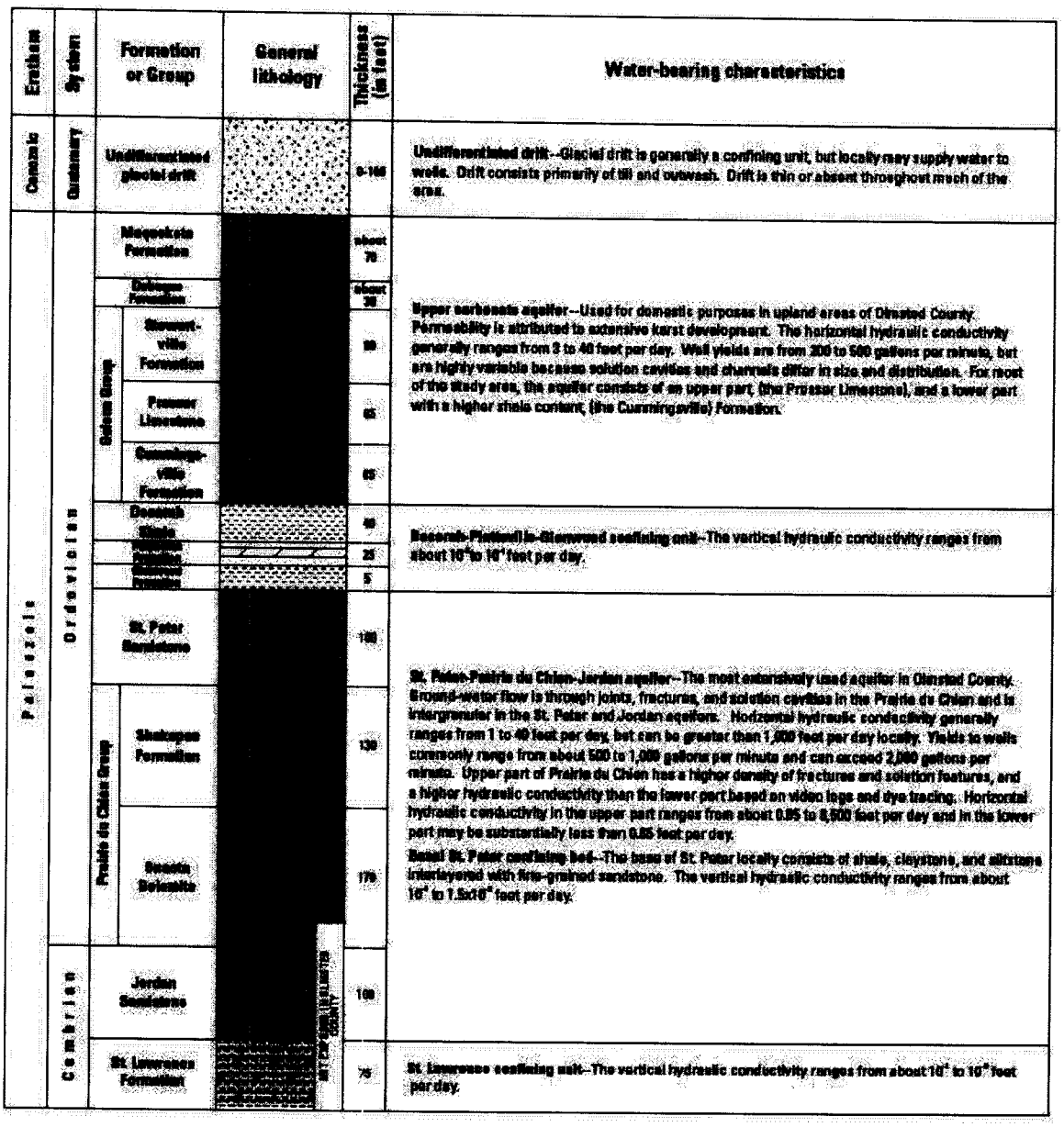


Figure 2 – Generalized hydrogeologic column of regional aquifers and confining units, Rochester, Minnesota from Lindgren (2001).

as to determine capture zones and drinking-water supply management areas around municipal wells.

The model has three layers that represent three geologic units that are the major sources of water for the Rochester area: (1) St. Peter Sandstone, (2) limestone and dolomites of the Prairie du Chein Group, and (3) Jordan Sandstone (Delin, 1991). This model does not simulate the effects of preferred ground-water flow along bedding planes, fractures, and karstic features commonly found in all three of these geologic units (Runkel and others, 2003).

Over the past few years, improvements to and additional packages available to MODFLOW have increased the model's ability to address the needs of local water managers (Barlow and Harbaugh, 2006). For example, the Local Grid Refinement (LGR) capability allows modelers to regrid portions of an existing model, allowing for more detailed or refined analysis of areas of particular interest (Harbaugh, 2005; Mehl and Hill, 2006). This capability is particularly helpful to water managers in delineation of wellhead protection areas around municipal wells and in assessing water conflicts in the vicinity of municipal wells. The Ground-Water Management (GWM) Process can now be applied to address several types of ground-water-management issues in Rochester. This may include minimizing the impact of municipal ground-water withdrawal on streamflow (Barlow and Harbaugh, 2006; Ahlfeld and Mulligan, 2000; Ahlfeld and others, 2005). RPU could use results from these optimization simulations to better determine municipal water pumpage configurations that minimally impact surrounding water resources, including local streams. Pumping costs for Rochester's municipal supplies also could be evaluated using the GWM optimization simulations. The recently-developed streamflow-routing (SFR2) package (Niswonger and Prudic, 2006) and multi-node well (MNW) package (Halford and Hansen, 2002) will also allow for improved simulation of stream discharge and municipal well pumping in Rochester.

OBJECTIVE

The objectives of the study are to (1) to assess ground-water flow conditions in the city of Rochester, MN and (2) use an upgraded ground-water flow model to make ground-water management scenarios throughout the Rochester metropolitan area.

RELEVANCE AND BENEFITS

Updating the existing MODFLOW model for the Rochester area will provide RPU with a valuable tool with which needed to assess the effects of pumping from municipal wells on surrounding water resources. The updated model will be applied to better develop and review drinking water management areas for existing and future municipal wells. As the city expands, the local gridding option in the MODFLOW 2005 simulation will provide the potential to develop detailed model simulations for delineating capture zones around new wells. The application of the Ground-Water Management (GWM) package and the collection of streamflow and water-quality data will help managers assess optimal ground-water withdrawal rates that limit stream water capture by the city's wells, achieving a balance between the human and in-stream flow requirements. The modeling results will also be of benefit to the Minnesota Department of Health in developing MODFLOW models in complex bedrock terrain where wellhead protection plans need to be developed for other communities in southeastern Minnesota.

The USGS will benefit by advancing the knowledge of the hydrogeology of southeastern Minnesota through data analyses and interpretations and by obtaining a better understanding of ground-water flow in a complex bedrock setting. The USGS also will benefit from the application of the recently developed MODFLOW packages in karst and fractured rock in southeastern Minnesota for which integrated modeling tools currently do not exist. The approach used for this study may be applied in a variety of new situations for which integrated modeling simulations currently do not exist.

Drinking-water availability and quality as well as hydrologic-system management are listed as priority water-resource issues in the Strategic Directions for Water Programs (U.S. Geological Survey, 1999a). The development of model simulations to be used by communities for determining capture zones and sources for their water supplies falls under the Water Supply and Demand category listed as a priority issue in the USGS Priority Issues for the Federal-State Cooperative Program document (U.S. Geological Survey 1999b). Determination of water use for meeting future human, environmental, and wildlife needs is an integral part of the recent USGS science strategy for applying USGS science to address societal needs (U.S. Geological Survey, 2007).

APPROACH AND WORK PLAN

This cooperative study undertaken by the USGS and RPU will be conducted between January 2008 and September 2012. A MODFLOW 2005 steady-state simulation for the Rochester Area will be constructed, calibrated, and applied to address these issues. RPU currently uses a MODFLOW-88 steady-state simulation developed by the USGS (Delin, 1991) to determine capture zones and drinking-water management areas around the city's municipal wells and to address well interference issues. New packages available for MODFLOW 2005 for localized grid refinement simulating ground-water management scenarios and streamflow will greatly improve the simulation of ground-water/surface-water interactions and ground-water flow in the Rochester Area. To calibrate the new steady-state model, water-level data will be collected during synoptic water-level measurements completed in the summer of 2008 and in the winter of 2009; streamflow data will be collected in the summer of 2009. If additional funding is added to the study, water-quality data, including temperatures, may be collected in streams and from municipal wells and used with modeling results to interpret municipal ground-water withdrawals supported by local stream depletions.

Initial model construction will be done between January 2008 and September 2008 based on the development of a stratigraphy for the modeled area and conceptualization of the model. RPU intends to contract with the Minnesota Geological Survey (MGS) to compile and interpret the latest hydrogeologic and stratigraphic data for the Rochester area. This interpretation will be

used to construct the stratigraphy and determine hydraulic parameters of the MODFLOW ground-water flow model. MGS geologists will interpret the stratigraphy for the Rochester area based on digital land surface elevations and existing knowledge of the structural geology and stratigraphy of the Rochester Area. This stratigraphic interpretation will be done based on comparison of existing geologic and borehole geophysical logs not previously incorporated into the model. Digital elevations of the MGS stratigraphic interpretation will be incorporated into the MODFLOW 2005 model using the Ground-Water Management System (GMS) interface. The MGS stratigraphic interpretation will only incorporate approximately 20% of the area covered by the Delin (1991) ground-water flow model. The USGS will develop the stratigraphy of the ground-water-flow model outside of the MGS stratigraphic interpretation using well logs in the Minnesota Department of Health's County Well Index System and stratigraphic coverages from the Minnesota Geological Survey (Minnesota Geological Survey, 2007).

Synoptic water levels will be measured between January 2008 and March 2009 by collecting water-level data from monitoring and domestic wells in the model area. The USGS will work with RPU and Olmsted County Environmental Services interns to conduct the synoptic measurements. The USGS will select wells from well networks used by Delin (1991), Lindgren (1997), and Lindgren (2001) and a network developed by the Olmsted County Health Department. The interns will contact well owners and evaluate access to the wells to determine if the wells can be included in the network. Once the well network is established, the interns will survey the wells to NAD83 horizontal and NAVD88 vertical datums using Differential Global Positioning Systems Techniques. Water-level data will be collected by the RPU and Olmsted County Environmental Services interns over one or two-week periods in August 2008 and in February or March 2009. On average, these months represent maximum (August) and minimum (February or March) ground-water withdrawal periods in the Rochester area. Well information and water-level data collected will be entered into the USGS Ground-Water Site-Inventory System.

USGS technicians will conduct seepage runs between June and August 2008 in rivers, streams, and creeks in the vicinity of municipal wells, including Silver Creek, the South Fork of the Zumbro River, and Bear Creek. These seepage runs will be conducted under low-flow conditions immediately prior to or following the August 2008 synoptic water-level run. If streamflow conditions are too high between June to August 2008 to determine baseflow rates, the seepage runs will be done between June 2009 to August 2009. Stream discharge data will be entered into the USGS Automated Data Processing System.

Between October 2008 and January 2009, USGS hydrologists will develop a conceptualized model of the flow system. Model conceptualization will involve reevaluating model boundaries, hydrologic features, and hydrogeologic parameters from the Delin (1991) model. Changes will be made to the boundaries if it is determined that the location or head/flow

conditions of the boundary affect current flow conditions in the Rochester Area. Determination of the hydrologic features represented in the model will be based on their importance to the scale of the simulation and their ability to be effectively represented using MODFLOW 2005 and associated packages. These features may include rivers and streams with underlying saturated or unsaturated conditions, wetlands, lakes, and infiltration/storm water basins. Relevant packages and features to be considered are listed in Table 1. Assumptions needed to simplify simulation of the complex hydrologic setting will also be determined. Model layering will be more detailed than in the Delin (1991) model, based on findings from recent hydrogeologic investigations (Runkel and Tipping, 2003). The USGS hydrologist will work with RPU managers on the initial conceptualization of Rochester ground-water management scenarios to be simulated using the ground-water-flow model with the USGS Ground-Water Management Process Package. Hydrologic knowledge gained on recharge rates in the Rochester area by Delin (1991), Lindgren (1997) and Lindgren (2001) will be used to develop the conceptual model.

The model will be constructed by incorporating the MGS stratigraphic interpretation with the USGS-defined stratigraphy in areas outside of Rochester but in the ground-water flow model study area. Input and calibration files for MODFLOW 2005 will be created using data from the MGS stratigraphic interpretation, the Delin (1988) MODFLOW model, Lindgren (1997), and Lindgren (2001), and the synoptic ground-water-levels and seepage runs. A uniform model grid spacing of 100 by 100 meter will be used. This grid is more detailed than in the Delin (1991) model, which was as fine as 1,000 feet in the downtown Rochester area to as coarse as 11,100 feet on the periphery of the model (Delin, 1991). The refined grid in this new model will improve the accuracy of the simulations. The digital elevation model data will be used with geologic data from wells to define the land surface and the bedrock surface elevations of the model.

The USGS will calibrate and run sensitivity analyses on the constructed model. During model calibration, adjustments will primarily be made to the aquifer and stream-bed hydraulic properties to best match simulated hydraulic heads and streamflows with measured heads and stream discharge values. Adjustments may also be made to the recharge rates and conductance values for general head boundaries. As part of the calibration process, the PEST optimization code may be used to produce best estimates of hydraulic parameters from observation data. Once the model is calibrated, analyses will be done to determine the sensitivity of simulated water levels and streamflows to variations in model hydraulic parameters. These analyses involve running the model multiple times and varying the value of a single parameter during each run. Changes in ground-water levels at each of the observation wells and at various stream locations will be compared between the different model runs to evaluate the model sensitivity to each of the parameters.

Table 1 – MODFLOW 2005 packages and feature and their potential benefits or improvements to the Rochester model.

MODFLOW 2005 Package or Feature	Process	Benefits or Improvements to the Rochester	Relative to Delin (1991) MODFLOW Simulation
Ground-Water Management (GWM)	Ground-water Management Formulations	Aid in making decisions on municipal well locations and pumping rates relative to streamflow losses	New
Multi-Node Well (MNW)	Simulate wells intersecting multiple aquifers or fractures, partially penetrating wells, and horizontal wells	More accurately simulates wells penetrating the Prairie du Chien Aquifer, calculates water levels in wells rather than only in the nodes	New
Streamflow-Routing (SFR2)	Routes streamflow and unsaturated flow beneath streams	Improved simulation and tracking of ground-water/surface-water interactions, streamflow losses	Improvement over the Streamflow-Routing SFR1 Package used in the 1991 model
Unsaturated-Zone Flow (UZF1)	Simulates unsaturated flow between land surface and water table	Simulates unsaturated flow conditions beneath infiltration basins	New
Conduit-Flow (CFP)	Simulates conduit, non-darcian flow by either deterministic (specifying conduits) or equivalent (distributed) methods	Simulates flow in karstic portions of the Prairie du Chien Aquifer more accurately	New
Local Grid Refinement (LGR) feature	Allows the user to develop a finer grid around a point of interest	Helpful in evaluating well interference and streamflow loss areas in the Rochester area	New

One or two management simulations will be run using the calibrated MODFLOW 2005 model and the Ground-Water Management Process (GWM) package to address potential well interference and ground-water/surface-water conflicts. The USGS will work with RPU to determine ground-water management scenarios, construct the input files for these simulations, run the simulations, make any modifications to the simulations, and demonstrate to RPU how the GWM process is accomplished. Results from the initial GWM simulations will be compared to future Rochester water usage plans to determine modifications that might be made to future GWM simulations. Other GWM simulations may be done by the USGS in future years.

Between May 2010 and September 2011, a USGS Scientific Investigations Report will be written summarizing results from the study. Between October 2011 and September 2012, the

USGS will address final comments and publish the report as a printed document and/or as a web page.

QUALITY-ASSURANCE PLAN

During the synoptic study, water-level measurements will be collected following water-level measurement protocols outlined in the Minnesota Water Science Center Quality Assurance Plan for Ground-Water Activities (http://mn-internal.cr.usgs.gov/mnlocal/techSupportQA/gw.qa.plan.01/), April 2003). Stream discharge measurements made during the seepage runs will be made following protocols outlined in the Minnesota Water Science Center Surface-Water Quality Assurance Plan (http://mn-internal.cr.usgs.gov/mnlocal/techSupportQA/SWQAPlan.pdf, May 2007).

PRODUCTS

A MODFLOW 2005 model of the Rochester Area will be available to RPU personnel and others interested in simulating ground-water flow conditions in the Rochester Area. A USGS Scientific Investigations Report will be published in September 2012 summarizing results from the study. The report will describe the Rochester model, outline the calibration and sensitivity analyses, and summarize results from the GWM simulations. Data collected during the two synoptic ground-water-level runs and the seepage runs will also be included in the report. Illustrations will show the potentiometric surface for different aquifers in the Rochester area based on the ground-water levels measured during August 2008 and May 2009 synoptic runs. A description of the model, the process used to calibrate the model, and results from the sensitivity analyses will be part of the report. Plots comparing observed and simulated ground-water levels and observed and simulated streamflows will be included in the report. A description of the GWM optimization simulation and results from the simulations will also be included. Synoptic ground-water-level measurements and seepage run data will be entered into the USGS NWIS database system. The model and GWM simulations will be archived in the USGS Minnesota Science Center Model Archive.

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WORK PLAN

Work Tasks	Major Elements		Starting Date	Ending Date	Required Staff
Developing an updated stratigraphic model for the MODFLOW simulation	**USGS Tasks** 1) **Verify and make changes to the stratigraphy of the existing MODFLOW model outside of the city of Rochester but in the model area through comparison with well logs in the Minnesota County Well Index and USGS GWSI data bases.**	Minnesota Geological Survey Tasks 1) Interpret the stratigraphy for the city of Rochester, MN from digital elevation model and structural geology. 2) Verify and make changes to the stratigraphic interpretation through comparison with existing well logs in the Minnesota County Well Index and compiled well logs.	January 2008	September 2008	MGS geologist, USGS hydrologist (10% time)
Synoptic water-level	**USGS Tasks** 1) **Design a monitoring**	RPU/Olmsted Co. Environmental	January	March	USGS hydrologist

study	**well network from existing wells in the USGS GWSI database and Olmsted County Environmental Services Observation Well Network.** **2) Enter water-level data into USGS Ground-Water Inventory System.**	Services Tasks 1) Contact well owners for permission to collect water-level data. 2) Survey the wells to obtain vertical elevation and horizontal locations. 3) Collect water-level data from the wells during maximum (August 2008) and minimum (February-March 2009) ground-water withdrawals.	2008	2009	(6% time), USGS hydrologic technician (4% time), RPU student, Olmsted County Environmental Services student
Seepage Run	**USGS Tasks** **1) Measure stream discharge along Silver Creek, South Fork of the Zumbro River, and Bear Creek under low-flow conditions immediately prior to or following the summer synoptic water-level run.** **2) Enter stream discharge data into USGS databases.**		June 2008	October 2008	USGS Surface-water technician – student (4% time)
Model conceptualization	**USGS Tasks** **1) Determine the hydrologic features and boundaries to be included in the model** **2) Outline and justify the assumptions in the model** **3) Determine how the features will be represented in the model** **4) Selection of MODFLOW features and packages to be included in**		October 2008	January 2009	USGS hydrologist (5% time),

	the model. **5) Work with RPU managers to initially define potential ground-water management scenarios for the city of Rochester that may be simulated in the model using the Ground-Water Management package.**			
Model construction	**USGS Tasks** **1) Incorporate the MGS stratigraphic interpretation of the Rochester area and the USGS-defined stratigraphy of areas outside of Rochester into the MODFLOW model (U.S. Geological Survey).** **2) Build input files for MODFLOW packages used in the model, including determining hydraulic parameters and boundary conditions.**	October 2008	September 2009	USGS hydrologist (35% time – FY09, 5% time FY10),
Calibration and sensitivity analysis of MODFLOW 2005 simulation	**USGS Tasks** **1) Compare model generated ground-water level and flow data to ground-water level data from the two synoptic measurements and collected from municipal wells, and collected stream discharge data.** **2) Adjust hydrologic parameters and boundaries in the model to make simulated and observed water-level and flow data match as close as possible.** **3) Construct and run a set of sensitivity simulations to assess the model's sensitivity to variations in various model parameters.**	September 2009	April 2010	USGS hydrologist (15% time)
Develop and Run Ground-Water Management (GWM) process simulations	**USGS Tasks** **1) Work with RPU managers to determine ground-water management scenarios for the city of Rochester that will be simulated in the model using the Ground-Water Management package.** **2) Build input files for one or two simulations addressing current and potential future ground-**	January 2010	September 2010	USGS hydrologist (30% time)

	water usage conflicts in the Rochester Area. 3) **Run the simulations and compare the results to RPU water usage plans**			
Write a USGS Scientific Investigations Report	**USGS Tasks** 1) **Summarize model conceptualization, model calibration and results of ground-water management simulations** 2) **Summarize results of synoptic water-level data, stream discharge data, and any water-quality data.**	May 2010	September 2011	USGS hydrologist (38% time), USGS illustrator, USGS editor
Address Reviews and Make Corrections to the USGS Scientific Investigations Report	**USGS Tasks** 1) **Address editorial and technical comments to reviews of the report.** 2) **Publish the report via printed copies and/or web.**	September 2011	September 2012	USGS hydrologist (8% time)

PERSONNEL

A hydrologist will commit about 340 hours (16% time) in FY2008, 830 hours (40% time) in FY2009, 890 hours (43% time) in FY2010, 800 hours (38% time) in FY2011, and 160 hours (8% time) in FY2012 on the project. The hydrologist will be the project chief, overseeing the project's design, budget, field work, and ground-water-flow modeling, and refining the scope of the study. A USGS surface-water technician will commit about 2 weeks (4% time) in FY2008 to collect stream discharge measurements during the seepage run. A USGS hydrologic technician will commit about two weeks (4% time) in FY2009 to enter collected stream discharge and ground-water-level data into USGS data bases.

BUDGET

Cooperating Agencies	FY2008	FY2009	FY2010	FY2011	FY2012
Rochester Public Utilities	$27,000	$75,000	$80,000	$85,000	$25,000
U.S. Geological Survey	$25,000	$50,000	$55,000	$60,000	$15,000

Total	**$52,000**	**$125,000**	**$135,000**	**$145,000**	**$40,000**

USGS Detailed Budget

ITEM	FY2008	FY2009	FY2010	FY2011	FY2012
Salaries *	$46,247	$117,657	$135,000	$139,537	$35,304
Travel *	$2,213	$4,895	$0	$5,463	$0
Vehicle *	$1,328	$2,448	$0	$0	$0
Equipment and Supplies *	$2,213	$0	$0	$0	$0
Printing Costs *	$0	$0	$0	$0	$4,696
Total:	$52,000	$125,000	$135,000	$145,000	$40,000

* - Costs include technical support, Center and Headquarters Overheads, and Facilities Charges

SAFETY

Proposal Job Hazard Analysis – Central Region

- Check the numbered box(s) for all significant safety concerns this project should address. Significant safety concerns are commonly those that require training, purchase of safety equipment, or specialized preparation to address potentially hazardous conditions.
- Identify any unlisted safety concerns at bottom of the page.
- Provide details on the back of this page.

Proposal Number_____
Project Title (Short) Rochester MODFLOW Model
Project Chief or Proposal Author Perry M. Jones

√	Potential Project Safety Elements
1.X	Wading, bridge, or cableway measurements or sampling (WRD 99.32 & 01.05)
2.	Working on ice covered rivers or lakes (see WRD 00.03)
3.	Measuring or sampling during floods
4.	Well drilling; coring, augers, hydro-punch, borehole logging

5.	Electrical hazards in the work area – above and below ground
6.	Construction – including cableways, trenching and demolition
7.X	Working in remote areas, communication, office call in procedures (OP94.02)
8.X	Ergonomics, Office issues, carpal tunnel syndrome
9.X	Field Vehicles appropriate for task?- Safety screens, equipment restraints.
10.	All terrain vehicles, snowmobiles, fork lifts,
11.	Helicopter or fixed wing aircraft usage (see OAS at: http://www.oas.gov/)
12.X	Site access: Federal, State, County and private lands
13.X	Hypothermia or Hyperthermia (heat stress)
14.X	Hantavirus, Lyme Disease, Histoplasmosis, Pfiesteria, Others?
15.	Contaminated water or soil with sanitary, biological, or chemical concerns
16.	Immunizations - voluntary programs
17.	Laboratory or mobile laboratory. Chemical hygiene plan, HazComm & MSDS's
18.	Hazardous waste disposal – Lab and Field
19.	Hazardous waste site operations (RCRA, CERCLA) HASP, HAZWOPPER
20.	Confined space – Stilling Wells, Well Pits, Sample sites
21.	Radioactivity – Borehole logging – Soil Moisture -
22.	Respiratory protection – Dusts, Vapors, Fumes, Biologic (medical monitoring)
23.X	Water levels – wells, well pits, pumps and electrical issues
24.	Electrofishing (see http://1stop.usgs.gov/safety/Topic/jha/electrofishing.htm)
25.	High pressure compressed gas cylinders – handling and transport
26.	Boating – operator training, equipment, requirements, inspections

Box no.	For each numbered box checked on the previous page, briefly: A. Describe the safety concern as it relates to this project. B. Describe how this safety concern will be addressed. Include training, safety Equipment and other actions that will be required. C. Estimate costs.
1.	A. Standard concerns for wading measurements in stream or ditch. B. Read JHA titled "Wading Measurement" on Job Hazard Analyses Information page on Minnesota WSC internal web site and apply in the field. C. None.
7.	A. Standard concerns for working in remote areas. B. Read JHA titled "Remote-Solitary Field Work" on Job Hazard Analyses Information page on Minnesota WSC internal web site and apply in the field. C. None.
8.	A. Standard concerns for office work. B. Ergonomics training and read the JHA titled "Working at a Computer Terminal" on Job Hazard Analyses Information page on Minnesota WSC internal web site and apply in the office. C. None.
9.	A. Standard concerns for field vehicle operation. B. Defensive driving course, read JHA titled "Servicing Field Sites" on Job Hazard Analyses Information page

	on Minnesota WSC internal web site and apply in the office. C. None.
12.	A. Access concerns to private lands. B. Read JHA titled "Dealing with Hostile Public" on Job Hazard Analyses Information page on Minnesota WSC internal web site and apply in the field. C. None.
13.	A. Standard concerns for heat stress during field work. B. Read JHA titled "Environmental Hazards" on USGS Job Hazard Analyses page at USGS Water Resources – Safety internal web site at http://1stop.usgs.gov/safety/Topic/jha/index.shtml and apply in the field. C. None.
14.	A. Standard concerns for diseases and viruses encountered in the field. B. Read JHA titled "Environmental Hazards" on USGS Job Hazard Analyses page at USGS Water Resources – Safety internal web site at http://1stop.usgs.gov/safety/Topic/jha/index.shtml and apply in the field. C. None.
23.	A. Standard concerns for taking water-level readings from wells B. Read JHA titled "Ground Water Measurements" on USGS Job Hazard Analyses page at USGS Water Resources – Safety internal web site at http://1stop.usgs.gov/safety/Topic/jha/index.shtml and apply in the field. C. None.

Discussed job hazard analysis (JHA) with District Collateral Duty Safety Officer and/or copy of JHA given to Collateral Duty Safety Officer Yes X No_____

Proposal Author Perry Jones

Section Chief Don Hansen

Water Science Center Director Jim Stark (Acting)

Regional Safety Officer _____ Date _____

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ROCHESTER PUBLIC UTILITIES
PROPOSED GROUNDWATER PROJECT FUNDING (2008 - 2012)

Minnesota Geological Survey Proposed Portion of Project:
Geologic Investigations Applicable to Groundwater Management Concerns in the Rochester Metropolitan Area.

	Proposed Financial Contributions to Project					
	2008	2009	2010	2011	2012	
Rochester Public Utilities -	$ 51,948	$ -	$ -	$ -	$ -	$ 51,948
Minnesota Geological Survey -	$ -	$ -	$ -	$ -	$ -	$ -
Total Funding for Project -	$ 51,948	$ -	$ -	$ -	$ -	$ 51,948

U.S. Geological Survey Proposed Portion of Project:
Assessment of Groundwater Flow, and Groundwater and Surface Water Interaction in the Rochester Area, MN.

Cooperating Agencies	Proposed Financial Contributions to Project					
	FY2008	FY2009	FY2010	FY2011	FY2012	Total
Rochester Public Utilities -	$ 27,000	$ 75,000	$ 80,000	$ 85,000	$ 25,000	$ 292,000
U.S. Geological Survey -	$ 25,000	$ 50,000	$ 55,000	$ 60,000	$ 15,000	$ 205,000
Total Funding for Project -	$ 52,000	$ 125,000	$ 135,000	$ 145,000	$ 40,000	$ 497,000

Project Funding Summary:

Rochester Public Utilities -	$ 78,948	$ 75,000	$ 80,000	$ 85,000	$ 25,000	**$ 343,948**
Minnesota Geological Survey -	$ -	$ -	$ -	$ -	$ -	$ -
U.S. Geological Survey -	$ 25,000	$ 50,000	$ 55,000	$ 60,000	$ 15,000	**$ 205,000**
Total for Project -	$ 103,948	$ 125,000	$ 135,000	$ 145,000	$ 40,000	**$ 548,948**

Rochester Public Utilities, 4000 East River Road NE, Rochester, Minnesota 55906-2813
telephone 507-280-1540 facsimile 507-280-1542

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RESOLUTION

BE IT RESOLVED by the Public Utility Board of the City of Rochester, Minnesota, to express its support for the proposed 2008-2012 Groundwater Investigation Project, and to approve the 2008 portion of the joint Project, to include:

A purchase order agreement with the Minnesota Geological Survey, University of Minnesota, in the amount of FIFTY-ONE-THOUSAND-NINE-HUNDRED-FORTY-EIGHT AND 00/100 DOLLARS ($51,948) for Geologic Investigations Applicable to Groundwater Management concerns in the Rochester Metropolitan Area;

and

The attached Joint Funding Agreement with the U.S. Geological Survey for the first year of the five-year project Assessment of Groundwater Flow, and Groundwater and Surface Water Interaction in the Rochester Area, MN, and a request that the Mayor and City Clerk execute the aforementioned Joint Funding Agreement, the amount of the local share of the first year of the project to be TWENTY-SEVEN-THOUSAND AND 00/100 DOLLARS ($27,000).

Passed by the Public Utility Board of the City of Rochester, Minnesota, this 29th day of January, 2008.

_____

President

_____

Secretary