2008 Lower Minnesota River Watershed District Fen Well Monitoring Report

Prepared for:
Lower Minnesota River Watershed District

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Prepared by:
Dakota County Soil and Water Conservation District

Introduction

A series of calcareous fens and trout streams run parallel to the Minnesota River, along the northwestern edge of Dakota County, in an area located roughly between I-494 and Hwy. 77. Groundwater monitoring wells have been installed in these fens to determine if groundwater, originating from upland areas, is providing enough cool groundwater to recharge these valuable natural resources (Appendix 1).

Several government agencies, including the United States Geological Survey, the Minnesota Department of Natural Resources (MNDNR), the Metropolitan Council, and the Ft. Snelling State Park have been involved in monitoring groundwater resources in this area. However, in recent years, very little monitoring has taken place. In order to continue documenting groundwater levels, the Lower Minnesota River Watershed District (LMRWD) began contracting with the Dakota County Soil and Water Conservation District (SWCD), in 2007, to collect monthly "depth to water" measurements, for a network of 28 fen wells. In 2008, the LMRWD contracted with the SWCD to continue collecting monthly well measurements.

2008 Activities

- Monthly "depth to water" measurements were collected at all wells.
- All wells were surveyed in to mean sea level by SWCD staff and MNDNR survey crews.
- Well construction and location information has been submitted to Dakota County offices to obtain State of Minnesota well identification numbers for all wells.
- All 2008 well measurement data have been submitted to Minnesota Climatology Working Group website and are available online (http://climate.umn.edu/ground_water_level_LMRWD/).

Weather Summary

Groundwater levels are often influenced by recent precipitation, especially in relatively shallow wells, similar to those monitored in the LMRWD. The 2007-2008 average monthly precipitation was 2.31 inches, and has been relatively consistent, with the exception of higher amounts observed in August/September of 2007 (Figure 1). As shown in Figure 2, precipitation amounts in 2008 were substantially lower than the 50 year average (28.9 inches).

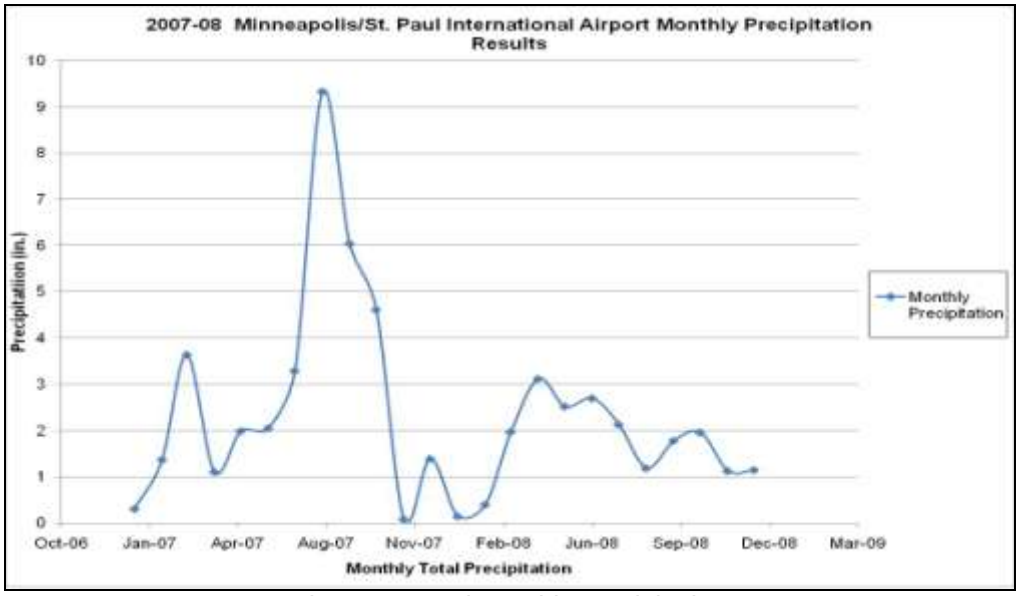

Figure 1. Total Monthly Precipitation

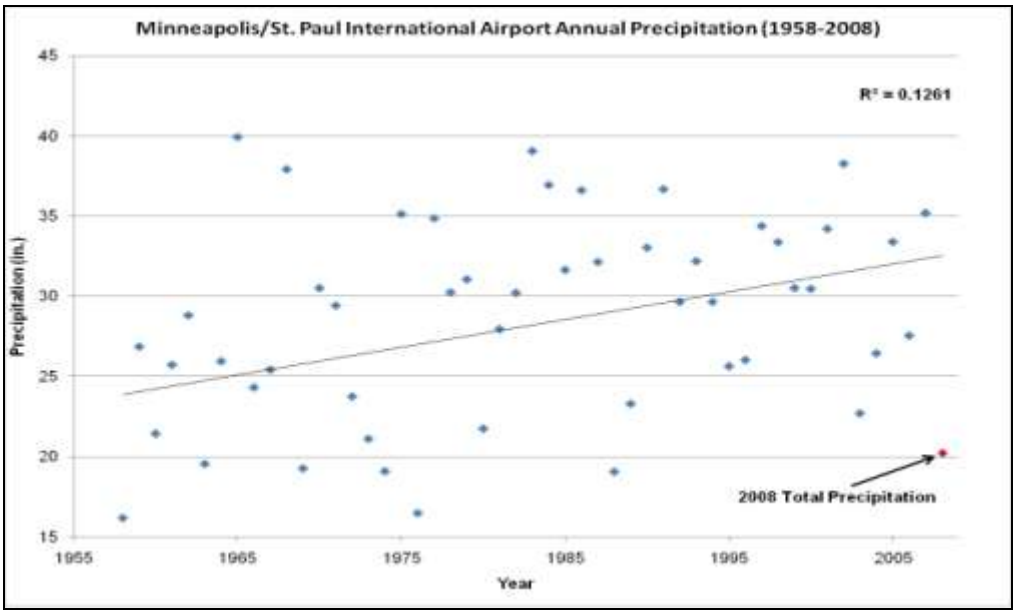

Figure 2. MSP Airport 50 Year Annual Precipitation Record

Quarry Island Fen Results

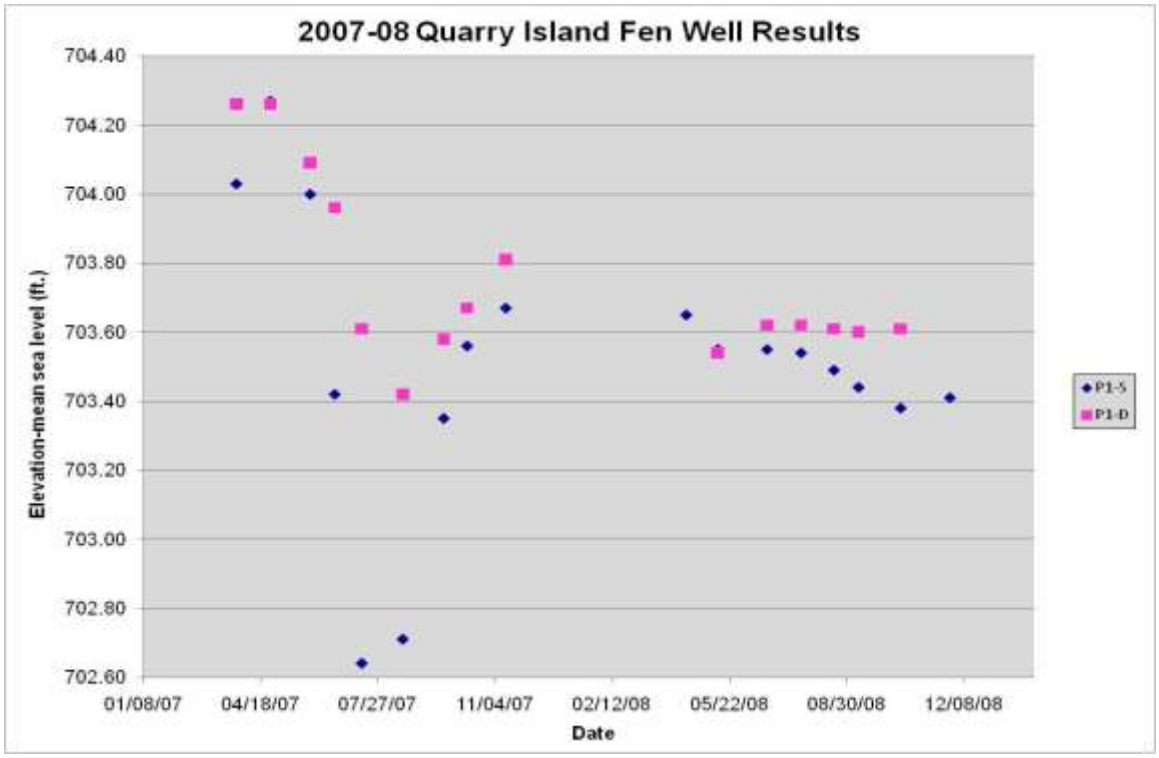

Figure 2. Quarry Island Fen Well Monitoring Results

Snelling Fen Results

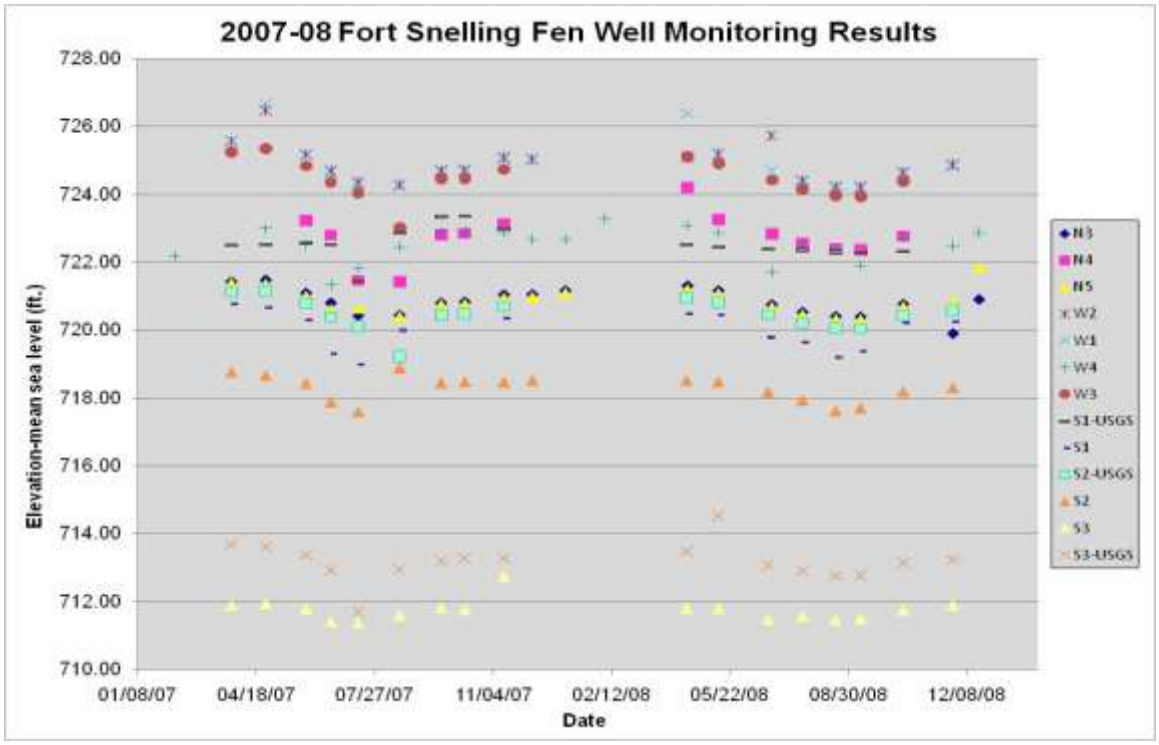

Figure 3. Snelling Fen Well Monitoring Results

Nichols Fen Results

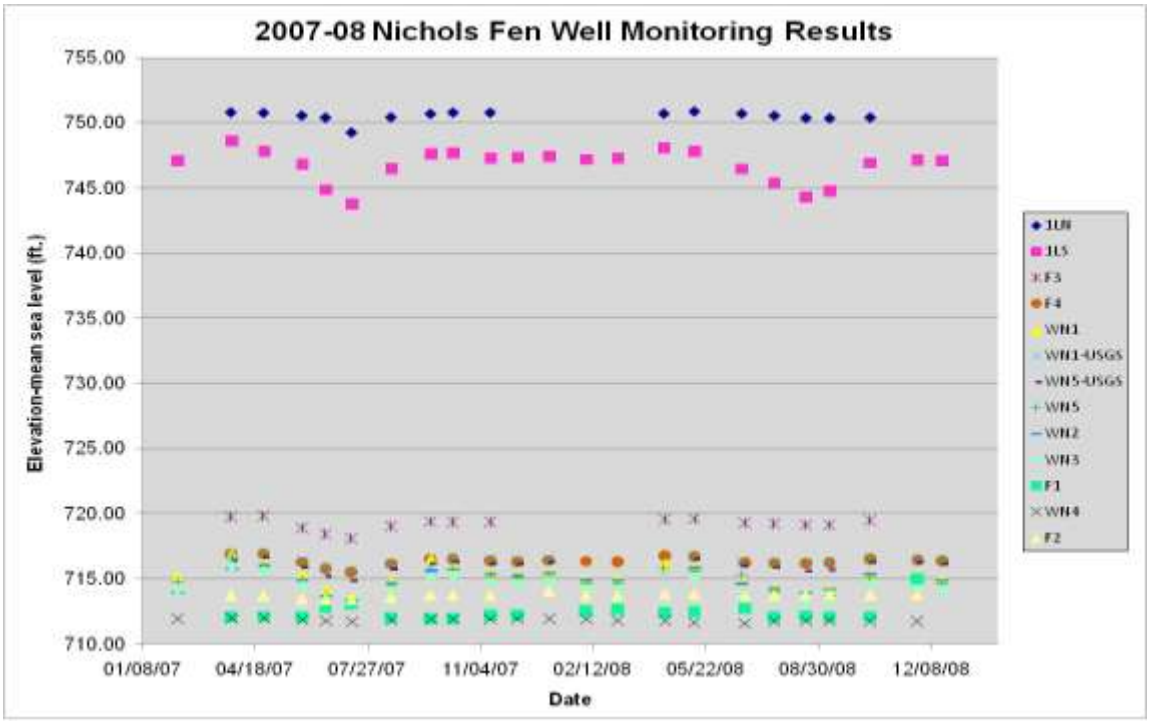

Figure 4. Nichols Fen Well Monitoring Results

Discussion

In 2008, Dakota County Soil and Water Conservation (SWCD) staff collected monthly "depth to water" measurements at all fen monitoring wells. In some cases, wells were frozen during the winter of 2008, but thawed quickly in the early spring months. Several wells were found to be frozen when the final 2008 measurement was taken in December.

Water elevations between 2007 and 2008 were very consistent and followed similar annual patterns (Figures 2-4). Water elevations decreased over both summer seasons, and rebounded as precipitation increased in the fall. Although monthly fen well measurements do not closely follow recent precipitation patterns, measurements do reflect general precipitation trends, especially during summertime periods of low rainfall.

Due to the brief period of record for this monitoring effort, a limited regression analysis was performed on the datasets for each well. A trend line was fitted to monthly data from each well to determine if water levels are increasing or decreasing (Table 1). A "goodness of fit" test was completed for all trend lines, with R^2 values ranging from 0.00008 to 0.4049. Due to these low R^2 values, all trends should be considered weak.

Table 1. 2007-08 Fen Well Regression Analysis

Quarry Island Fen Trends		
Well	2007-08 Trend	R^2 (Trend Fit)
P1-S	-	0.0265
P1-D	+	0.4049
Fort Snelling Fen Trends		
Well	2007-08 Trend	R^2 (Trend Fit)
N3	-	0.2353
N4	+	0.0301
N5	-	0.0118
W2	-	0.1203
W1	-	0.1145
W4	+	0.0122
W3	-	0.0678
S1-USGS	-	0.0434
S1	-	0.0585
S2-USGS	-	0.0422
S2	-	0.1697
S3	-	0.0209
S3-USGS	-	0.00008
Nichols Fen Trends		
Well	2007-08 Trend	R^2 (Trend Fit)
1LN	+	0.0018
1LS	-	0.0285
F3	+	0.031
F4	+	0.0005
WN1	-	0.0835
WN1-USGS	+	0.0006
WN5-USGS	+	0.0096
WN5	-	0.0605
WN2	-	0.0009
WN3	-	0.1234
F1	+	0.1129
WN4	-	0.355
F2	+	0.2468

In general, water elevation trends were mixed, with the exception of the Fort Snelling fen wells. The majority of these wells (11 out of 13) appear to have a weak decreasing water elevation trend. This may be the result of a recent localized decrease in rainfall amounts. Again, these trends should be considered weak, and may not reflect actual water elevation trends occurring in any of the fen wells. Additional monthly measurements from these wells are needed to expand upon existing baseline data and to provide for a stronger trend analysis in future reports.

Suggestions for future monitoring:

- Continue collecting monthly measurements to help identify annual, as well as long term trends.
- Discontinue well measurements during winter months (December-March). The majority of wells monitored are frozen in the winter.
- Discontinue providing annual Excel copy of monitoring data to LMRWD staff as all data are now available on the Minnesota Climatology Working Group website and the spreadsheet is very large.

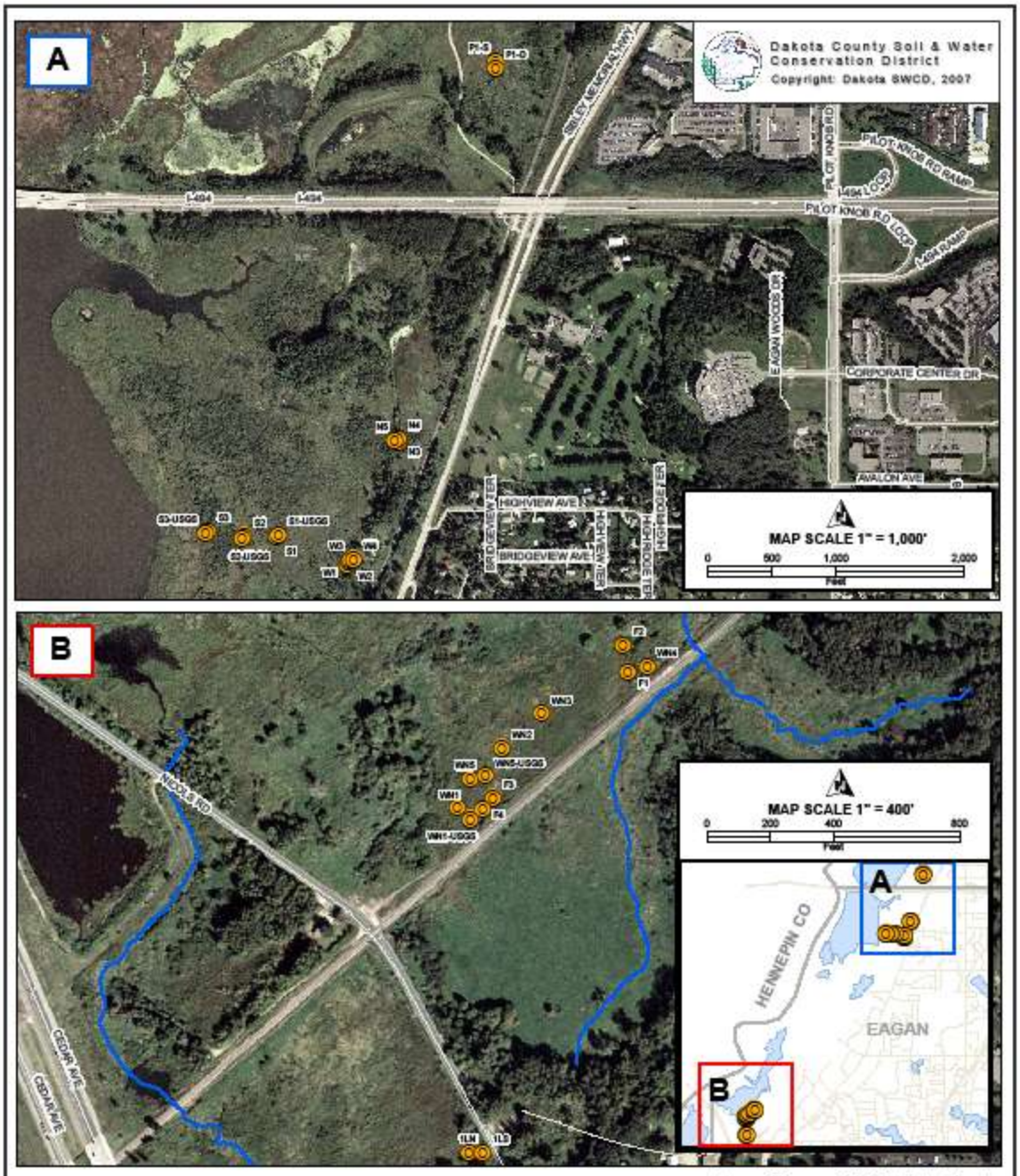

Image Source: 2006 Dakota County

Legend

Monitoring Sites

This drawing is neither a legally recorded map nor a survey and is not intended to be used as one. This drawing is a compilation of records, information and data located in various City, County, and State Offices and other sources, affecting the area shown, and is to be used for reference purposes only. Dakota County SWCD is not responsible for any inaccuracies herein contained. If discrepencies are found please contact the Dakota County Soil & Water Conservation District at 651.480.7777.

Appendix 1
2007 FEN WELL MONITORING LOCATIONS

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