2009 Lower Minnesota River Watershed District Fen Well Monitoring Report

Prepared for:
Lower Minnesota River Watershed District

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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 2009, the LMRWD contracted with the SWCD to continue collecting monthly well measurements.

2009 Activities

- Monthly "depth to water" measurements were collected at all wells.
- Coordinated with MNDNR staff to create a map based, web access page for well monitoring data (http://climate.umn.edu/ground_water_level_LMRWD/).
- Discontinued January and February fen well measurement in an attempt to minimize costs, especially since most of the wells are frozen in the winter months.

Weather Summary

Groundwater levels are often influenced by recent precipitation, especially in relatively shallow wells, similar to those monitored in the LMRWD. The 2007-2009 average monthly precipitation was 2.19 inches and has been relatively consistent on an annual basis, with larger amounts occurring during mid-summer (Figure 1). When compared against 50 year precipitation records, 2009 (23.6 inches) was substantially drier than the 50 year average (28.9 inches).

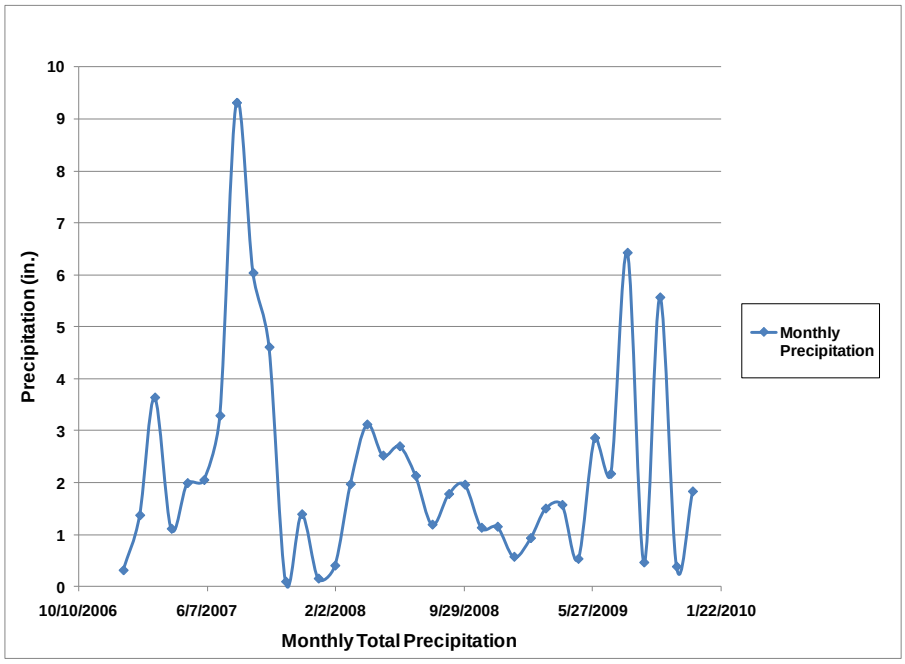


Figure 1. 2007-2009 Minneapolis/ St. Paul International Airport Monthly Precipitation Results

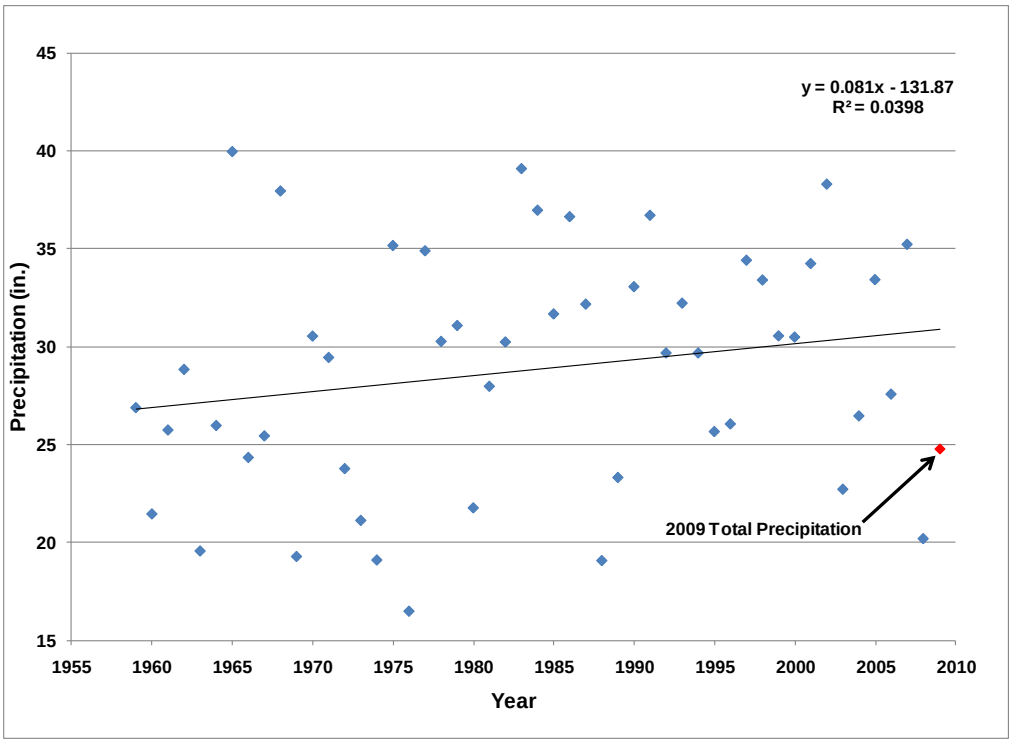


Figure 2. Minneapolis/St.Paul International Airport 50 Year (1959-2009) Annual Precipitation Record

Quarry Island Fen Results

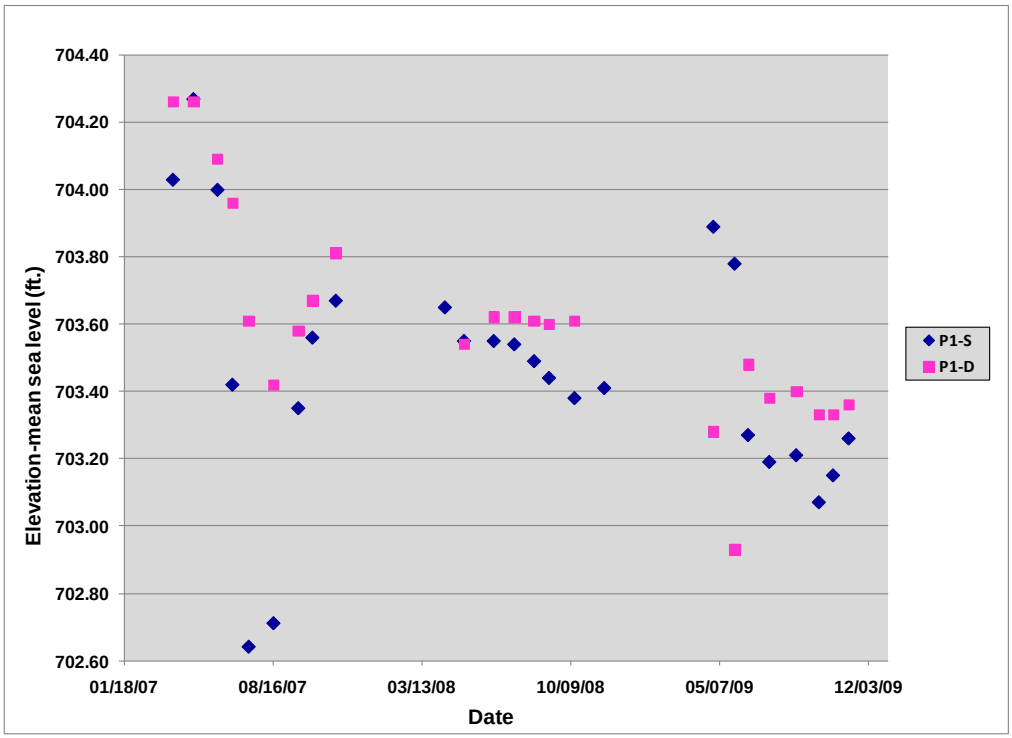


Figure 3. 2007-2009 Quarry Island Fen Well Monitoring Results

Snelling Fen Results

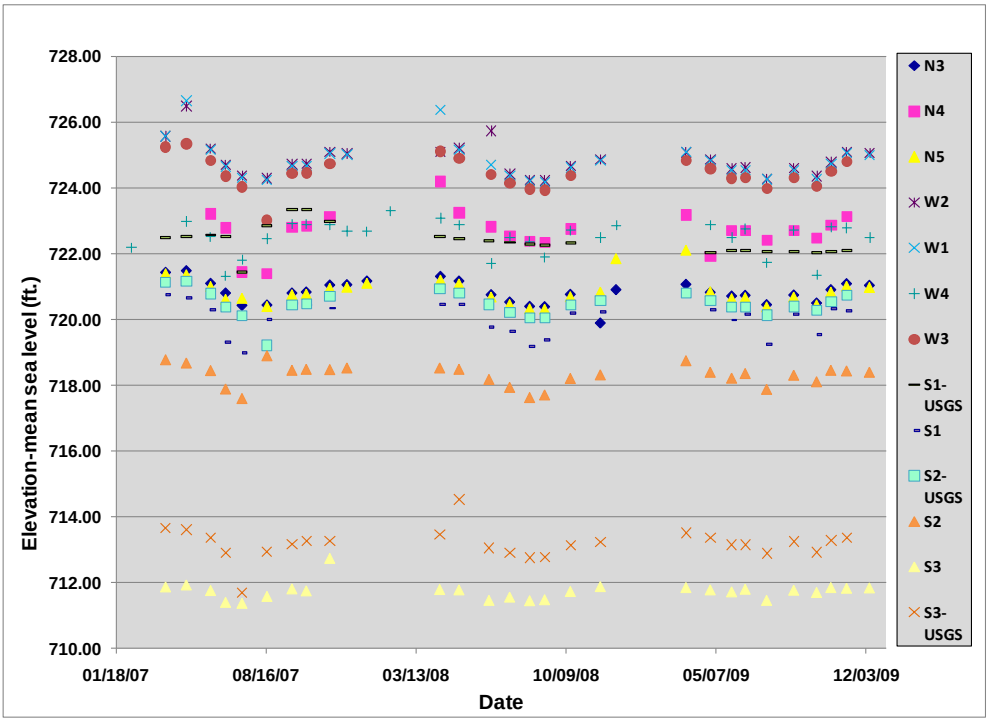


Figure 4. 2007-2009 Snelling Fen Well Monitoring Results

Nichols Fen Results

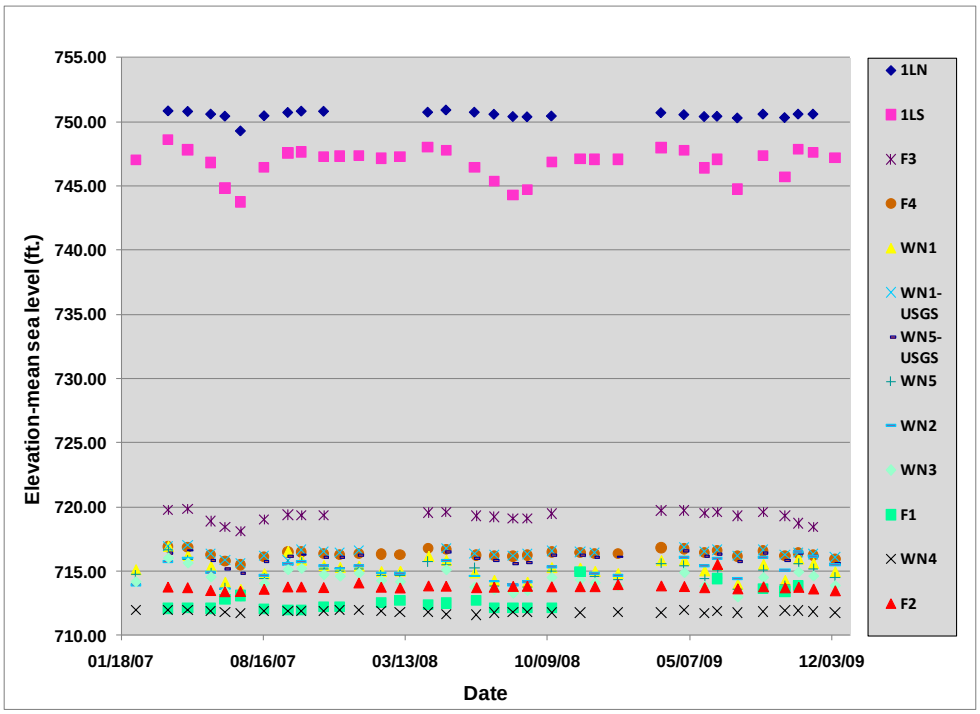


Figure 5. 2007-2009 Nichols Fen Well Monitoring Results

Discussion

Water elevations among the 2007-2009 monitoring years have been relatively consistent and follow similar annual patterns in the Snelling and Nichols fens (Figures 4-5). Water elevations in the shallow wells of the Quarry Island Fen appear to be less consistent and slightly decreasing (Figure 3). In general, water elevations have decreased during dry summer months, and rebounded as precipitation increased in the fall. Although monthly fen well measurements do not closely mirror 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 to 0.6145. Due to these low R^2 values, all trends should be considered weak.

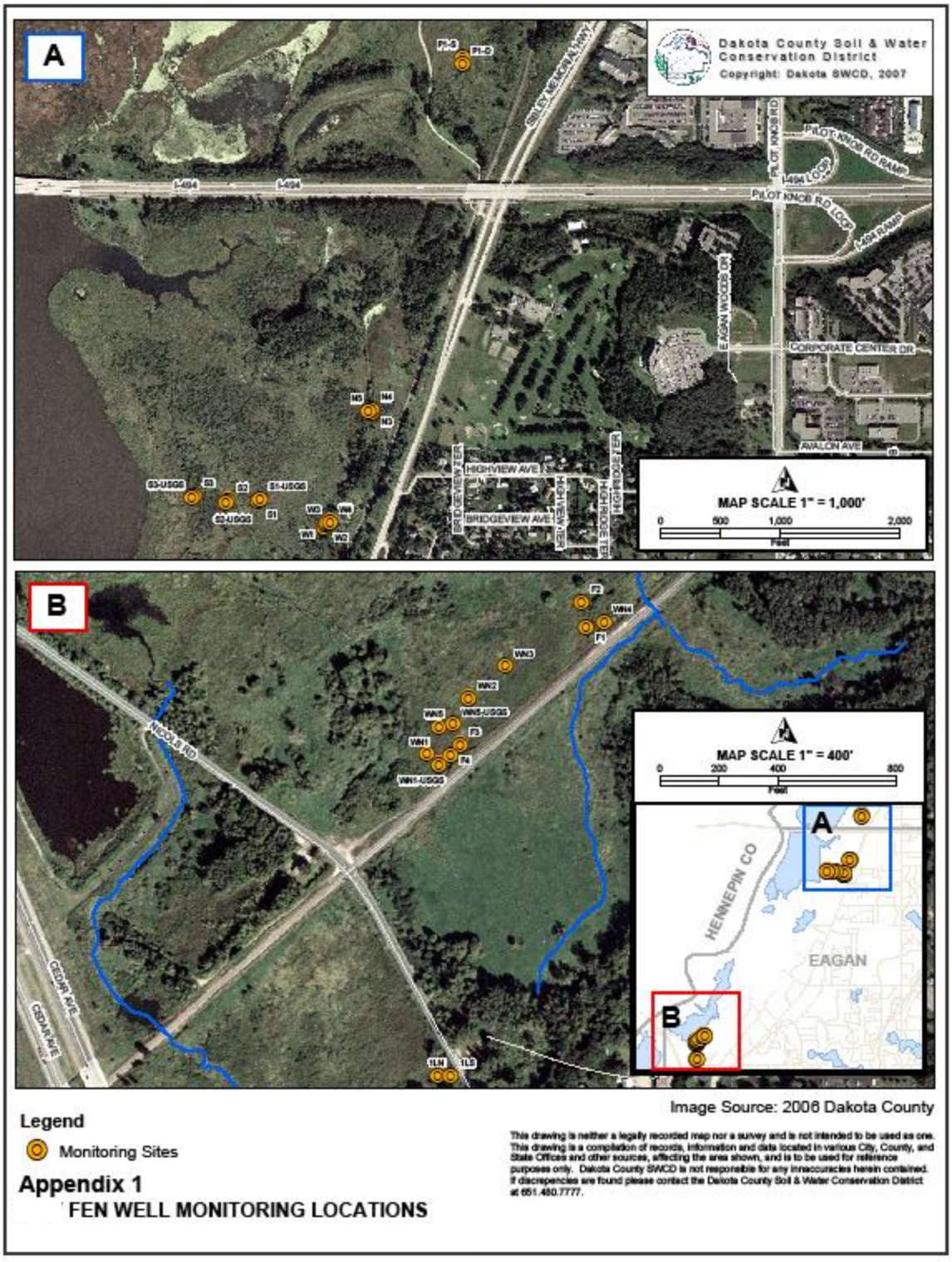
Based upon this analysis, water elevations in the Quarry Island and Fort Snelling fens appear to be decreasing across most wells, but these trends are generally weak (low R^2). However, one of the Quarry Island fens, P1-D, is beginning to show a stronger decreasing trend (R^2 = 0.6145). This trend could be due to local land and groundwater use or may simply be the result of recent dry weather (Figures 1-2). Additional monthly measurements are needed to expand upon existing baseline data and to provide for a stronger trend analysis in future reports.

Table 1. 2007-09 Fen Well Regression Analysis

Quarry Island Fen Trends		
Well	2007-09 Trend	R^2 (Trend Fit)
P1-S	-	0.0795
P1-D	-	0.6145
Fort Snelling Fen Trends		
Well	2007-09 Trend	R^2 (Trend Fit)
N3	-	0.0700
N4	+	0.0044
N5	-	0.0079
W2	-	0.0983
W1	-	0.0981
W4	-	0.0006
W3	-	0.0278
S1-USGS	-	0.3003
S1	-	0.0215
S2-USGS	-	0.0110
S2	-	0.0219
S3	-	0.0001
S3-USGS	+	0
Nichols Fen Trends		
Well	2007-09 Trend	R^2 (Trend Fit)
1LN	-	0.0050
1LS	+	0
F3	+	0.0097
F4	+	0.0009
WN1	-	0.0162
WN1-USGS	+	0.0009
WN5-USGS	+	0.0299
WN5	-	0.0196
WN2	+	0.1304
WN3	-	0.0765
F1	+	0.4240
WN4	-	0.0614
F2	+	0.0508

Suggestions for future monitoring:

- Continue collecting monthly measurements to help identify annual and long term trends in fen water table elevations.



Appendix 1

FEN WELL MONITORING LOCATIONS